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Database on Wind Characteristics

Users Manual

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November 2001

Abstract The main objective of IEA R&D Wind Annex XVII - Database on Wind Characteristics - is to provide wind energy planners and designers, as well as the international wind engineering community in general, with easy access to quality controlled measured wind field time series observed in a wide range of environments. The project partners are Sweden, Norway, U.S.A., The Netherlands, Japan and Denmark, with Denmark as the Operating Agent.

The reporting of IEA R&D Annex XVII falls in three separate parts. Part one deals with the overall structure and philosophy behind the database (including the applied data quality control procedures), part two accounts in details for the available data in the established database bank and part three is the Users Manual describing the various ways to access and analyse the data.

The present report constitutes part three of the Annex XVII reporting and contains a thorough description of the available online facilities for identifying, selecting, downloading and handling measured wind field time series and resource data from "Database on Wind Characteristics".

IEA R&D Wind Annex XVII
Database on Wind Characteristics

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1. Background

In 1996, the EU-DG XII (JOULE) project “Database on Wind Characteristics” was started. The project was concluded at the end of 1998 and resulted in a unique database of quality controlled and well-documented wind field measurements in a standardised format. The established data bank was supplemented with tools to enable access and simple analysis through an Internet connection using the World-Wide-Web. The contents and the facilities are reported in [1].

As a follow-up to the JOULE project, Annex XVII, within the auspices of the IEA R&D Wind, has been formulated with Sweden, Norway, U.S.A., The Netherlands, Japan and Denmark as active participants. The Annex entered into force on 1st January 1999, and will remain into force for an initial period of two and a half-year.

The main objective of Annex XVII is to provide wind energy planners and designers, as well as the international wind engineering community in general, with easy access to quality controlled measured wind field time series observed in a wide range of environments. From its inception Annex XVII has successfully met the purpose by ensuring that the database is always on-line and available through the Internet, and by making possible and managing the continuous development and dissemination of the database.

2. Introduction

The reporting of Annex XVII falls in three separate parts. Part one deals with the overall structure and philosophy behind the database (including the applied data quality control procedures), part two accounts in details for the available data in the established database bank and part three is the Users Manual describing the various ways to access and analyse the data.

The present report constitutes part three of the Annex XVII reporting and contains a thorough description of the available online facilities for identifying, selecting, downloading and handling measured wind field time series and resource data from “Database on Wind Characteristics”.

The user manual is structured as follows: Chapter 3 outlines the basic terminology used throughout the Users Manual and Chapters 4 describes available search profiles of different complexity as well as related downloading and visualisation tools. Chapter 5 finally deals with the capabilities and handling of two supporting software packages (Dbwind and DANAP) as well as the possibilities of access to run statistics. The use of selected facilities is exemplified in the Appendices.

Note that most of the described facilities are available for registered users only.

3. Definitions

The definitions and terminology used throughout “Database on Wind Characteristics” are outlined in this Chapter. The definitions are categorised into five parts:

1. Basic definitions;
2. Definitions associated with the “Simple data selection” form;
3. Definitions associated with the “Advanced data selection” form;
4. Definitions associated with the “Site - channel data selection” form; and
5. Definitions associated the “Resource data selection” form.

3.1 Basic definitions

This Section contains a number of basic definitions. The following syntax is used:

- i Bold face (e.g. **Run**) indicates an item, which is defined/explained;
- ii Normal face (e.g. 199803422242) is used for exemplification;
- iii Items in brackets (e.g. [test]) refer to an input or to a physical unit;
- iv Underlined items, (e.g. mean) refer to additional information included as hyperlinks;
- v Italic face (e.g. *runname*) refers to items explained elsewhere in this document.

Run

A run consists of one or more time series each covering the same span in time [600 - 3600 seconds] with a unique starting time in terms of year, month, day, hour and minute. A run is identified by its *runname* and consists of one or more files.

Runname (199705061503)

The runname reflects the (initial) recording time for the time series.

- Year = 1997
- Month = 05
- Day = 06
- Hour = 15
- Minute = 03

Thus, in the example above the initial recording time is 6 May 1997 15⁰³.

Time series

A time series contains measurements from one or more channels recorded with a specific sample frequency. Each time series belongs to a particular *run* and is saved in a common ASCII file format. The selected format includes a header with general information, basic statistics and a data field with measurements scaled in physical units.

The basic statistics consists of channel identification, mean, standard deviation, minimum and maximum values for each signal referring to the entire run period.

The common file format is defined in Reference [1], Annex B4.

10 mins

Statistics (in terms of mean, standard deviation, min and max) as well as gust characteristics are calculated for each channel referring to a 10-minute period.

Channel

A channel is a derived or a direct signal from an instrument (e.g. wind speed, wind direction, temperature, sonic-x and sonic-u). The valid signal types are listed in Table 1.

Note that Table 1 also includes signal types, which refer to measured structural wind turbine loads.

Table 1: Signal types.

Signal types	Description	Units
acc	acceleration	m/s**2
ahum	absolute humidity	kg/m**3
baro	barometric pressure	hPa
bm	bending moments	kNm
cvut	sonic covariance u-T	~Km/s
cvuv	sonic covariance u-v	m**2/s**2
cvuw	sonic covariance u-w	m**2/s**2
cvvt	sonic covariance v-T	~Km/s
cvvw	sonic covariance v-w	m**2/s**2
cvwt	sonic covariance w-T	~Km/s
cx	current [sea], x-direction	cm/s**2
cy	current [sea], y-direction	cm/s**2
d	wind direction	deg
db_on	wind turbine disc brake on	Volt
f	force	kN
grad	global radiation	W/m**2
nrad	net radiation	W/m**2
pa	pitch angle	deg
pitd	wind speed based on dynamic pitot tube measurement	m/s
pow	wind turbine power (active)	kW
powa	wind turbine power (active)	kW
rain	precipitation	mm/hr
rhum	relative humidity	%
rich	Richardson number	-
rpm	rotor speed	rpm
s	wind speed from cup or propeller	m/s
sd	derived, zeroed, sonic direction (mean=0)	deg
sh	speed from hotwire	m/s
sht	temperature from hotwire	degC
shx	speed from hotwire, x- direction	m/s
shy	speed from hotwire, y- direction	m/s
shz	speed from hotwire, z- direction	m/s
six	sonic inclination, x-direction	deg
siy	sonic inclination, y-direction	deg
spx	speed longitudinal direction (propeller anemometer)	m/s

spy	speed lateral direction (propeller anemometer)	m/s
spz	speed vertical direction (propeller anemometer)	m/s
ss	derived sonic speed ($=\text{SQRT}(u^2+v^2)$)	m/s
st	sonic (virtual) temperature	degC
su	sonic component aligned in mean wind direction	m/s
sv	sonic component aligned in horizontal cross-wind direction	m/s
sw	sonic component aligned in vertical direction	m/s
sx	unaligned sonic horizontal component #1	m/s
sy	unaligned sonic horizontal component #2	m/s
sz	unaligned sonic vertical component	m/s
tabs	absolute temperature	degC
tdif	temperature difference	degC
teta	sonic anemometer co-ordinate rotation about z axis	deg
tilt	sonic anemometer tilt	deg
torq	wind turbine shaft torque	kNm
ustr	friction velocity u^*	m/s
wave	wave height	m
wt	wind turbine parameter [Volt]	V
yp	wind turbine yaw angle	deg

Instrument

An instrument is a sensor used to measure a physical quantity (e.g. wind speed, wind direction, temperature) and the valid types are listed in Table 2.

Table 2: Instrument types.

Type	Description
cup	Cup anemometer
cuva	Combined cup/vane
hotw	Hot wire, 3 dimensions
hum	Psychrometer
inclin	Speed inclination registration system
pitot	Pitot tube
pres	Barometer
prop	Propeller anemometer
propv	Propeller-vane, combined
rad	Pyrometer
rain	Precipitation, rain measurements
seac	Sea current registration system
sonic	Sonic anemometer
term	Thermometer
vane	Wind direction vane
wave	Wave height recorder
wtl	Wind turbine loads
wto	Wind turbine operational parameters

Ftp-server

The ftp-server (130.226.17.200) gives access to all the raw time series, which are stored on a fast 40 GB hard disc. Browsing-access to the ftp-server is possible through anonymous login

from the Web-server. Download of time series requires username and password, which are available on request from winddata@mek.dtu.dk.

Web-server

This server contains all html documents and scripts. The Web-server is used to access the indexed data located in the database.

Database-server

This server contains the database consisting of a number of tables, containing all the indexed values, background information and documentation of the measurement setup. Access to the database-server is performed through the tools available on the Web-server.

3.2 Definitions - simple data selection**Nominal values**

The simple data selection is based on nominal values. These are calculated as average values based on channels of identical signal type belonging to the same *run*. An example of a *simple data selection* procedure is illustrated in Appendix A. The definition of nominal values are further specified below where N (≥ 1), for each particular nominal signal type, denotes the number of available channels:

- a) **Nominal wind speed** is the averaged wind speed

$$V_n = \frac{1}{N} \sum_{i=1}^N V_i$$

- b) **Nominal turbulence intensity** is the averaged turbulence intensity

$$TI_n = \frac{1}{N} \sum_{i=1}^N TI_i$$

- c) **Nominal wind direction** is the averaged wind direction

$$DIR_n = \frac{1}{N} \sum_{i=1}^N DIR_i$$

3.2.1 Definitions - simple data query form

All the available options in the data selection form are *optional*. These are listed and explained in the following.

Min [3]

The values less than *Min* are excluded from the query (e.g. *Min* = 3 m/s means that all values below 3 m/s are excluded).

Max [23]

The values larger than *Max* are excluded from the query (e.g. Max = 23 m/s means that all values above 23 m/s are excluded).

Wind speed [m/s]

Category that enables specification of the nominal wind speed.

Turbulence intensity [%]

Category that enables specification of the nominal turbulence intensity.

Wind direction [deg]

Category that enables specification of the nominal wind direction.

Duration [sec]

Category that enables specification of the duration of time series (in the range [600 - 3600] seconds).

Terrain

Category that enables specification of the terrain type. The valid terrain classification should be according to the terrain type definitions listed in Table 3.

Table 3: Terrain types.

type	Description
bridge	measurements from a bridge
coastal	water and land
forest	forest
ice	snow and ice cover
offshore	open sea
pastoral	open fields and meadows
rural	agriculture with some buildings
sand	sand cover
scrub	bushes and small trees
urban	town

Orography

Category that enables specification of the type of orography. Orography means terrain height variations and the *dominant* orography must be selected according to Table 4.

Table 4: Orography types.

type	description
Flat	flat landscape
Hill	rolling hills
Mountain	sharp contours - separation expected

Site

Category that enables specification of a particular sites or all sites. A site represents a unique location with measurements.

Count - (button)

Number of *matching runs* fulfilling the requirements specified in the simple data selection form.

View - (button)

List of *matching runs*¹ fulfilling the requirements specified in the simple data selection form.

Files - (button)

List of file names of the *matching runs*¹ fulfilling the requirements specified in the simple data selection form. These files are available for download directly from the FTP-server.

3.2.2 Definitions - matching runs

Run = 199705061503

The *runname* refers to the starting time in terms of year (=1997), month (=05), day (=06), hour(=15) and minute(=03) and includes further a link to a *report page* with run statistics. The recording of this example is e.g. initiated at 15:03 the 6 May 1997.

Site = [aspruzza](#)

Unique site name with link to the actual site description.

Speed = 27.94

The nominal wind speed.

Dir = 233.8

The nominal wind direction.

Turb % = 11.45

The nominal turbulence intensity.

Duration = 3600.00

Duration of the resulting *run* [seconds].

3.2.3 Definitions - report

The report presents statistical information, identical to the statistical information in the file header for one single run, based on one or more files.

Run = 199705061503

The *runname* refers to the starting time in terms of year, month, day, hour and minute.

Site = [aspruzza](#)

Unique site name with link to the site description.

¹ The maximum number of matching runs, which can be viewed during one query, are limited to 500.

Start = 06-05-97 15:03:19

Unique recording start time for the actual *run* (e.g. 15:30 the 6 May 1997).

Duration = 3600.00

Duration of the resulting *run* [seconds].

File = /aspruzza/1997/day126/1503_010.zip

Unique filename and directory with information about site, date and time of recording, sampling frequency and compression technique based on pkzip.exe from PKWARE Inc.. This label contains a link to the exact file location in the FTP-server. Each compressed file only contains one data file with the extension “dat”.

Example: file=1503_010.zip contains one ASCII file=1503_010.dat, recorded with a frequency of 1 Hz.

The filename syntax is MS-DOS compatible and restricted to 12 characters “hhmm_fff.xxx” where

- hh=hour (2 digits);
- mm= minute (2 digits);
- _ = underscore “_”(1 digit);
- fff = $10 \times$ scanfrequency [Hz] (3digits);
- xxx=dat means file extension for the ASCII file;
- xxx =zip means file extension for the (pkzip) compressed file.

Frequency = 1.00

Sampling frequency referring to file [Hz].

Packed size = 27684

Size of compressed file [Bytes].

Channel = s11

Channel name with link to signal and instrument information.

Type = s

Signal type according to Table 1.

Freq = 1 .0

Sampling frequency referring to channel [Hz].

Height = 33

Instrument height above ground level [m].

Mean = 3.80

Mean value of a signal corresponding to the duration of the actual *run* - unit according to signal type.

Stdv = 1.18

Standard deviation of a signal corresponding to the duration of the actual *run* - unit according to signal type.

Min = 0.8

Minimum value of a signal corresponding to the duration of the actual *run* - unit according to signal type.

Max = 8.3

Maximum of a signal corresponding to the duration of the actual *run* - unit according to signal type.

Turbulence = 11.

Turbulence intensity [%].

3.3 Definitions - advanced data selection

The advanced data selection form is used for queries based indexed values, referring to 10-minute statistics, and consists of 3 different data selection forms (10-minute statistics, 10-minute transient events and 10-minute wind shear). An example of the "advanced data selection" procedure is illustrated in Appendix B.

Note: the reference period is 10 minutes and all input variables are optional in these forms.

3.3.1 Definitions - ten minute statistics query form

The 10 minutes values are all based on 600 seconds averaging time.

Min [3]

The values less than *Min* are excluded from the query (e.g. Min = 3 m/s means that all values below 3 m/s are excluded).

Max [23]

The values larger than *Max* are excluded from the query (e.g. Max = 23 m/s means that all values above 23 m/s are excluded).

Wind speed [m/s]

Category that enables specification of the nominal wind speed.

Turbulence intensity [%]

Category that enables specification of the nominal turbulence intensity.

Wind direction [deg]

Category that enables specification of the nominal wind direction.

Sensor height [m]

Category that enables specification of sensor height [interval] (above ground level).

Site [all]

Category that enables specification of a particular sites or all sites. A site represents a unique location with measurements.

Runname

Select a specific or a group of *runnames* (e.g. 199801% results in time series recorded in January 1998). *Note that wildcard is "%"*.

Transient events

Select transient events to include items concerning wind speed gusts, wind acceleration gusts, wind direction gusts and wind direction angular velocity gusts.

Wind shear

Select wind shear to include items concerning wind shear.

Options

No options are available yet.

3.3.2 Definitions - ten minute transient events query form**Period [sec]**

Select data the indexing period T , where T refers to the extend of a moving time window - the gust reference time span. The data indexing has been performed with four different reference time spans (2, 5, 10 and 30 seconds) as shown on Figure 1.

Note: data representing $T=2$ are omitted for slow sampled data (i.e. less than 2 Hz).

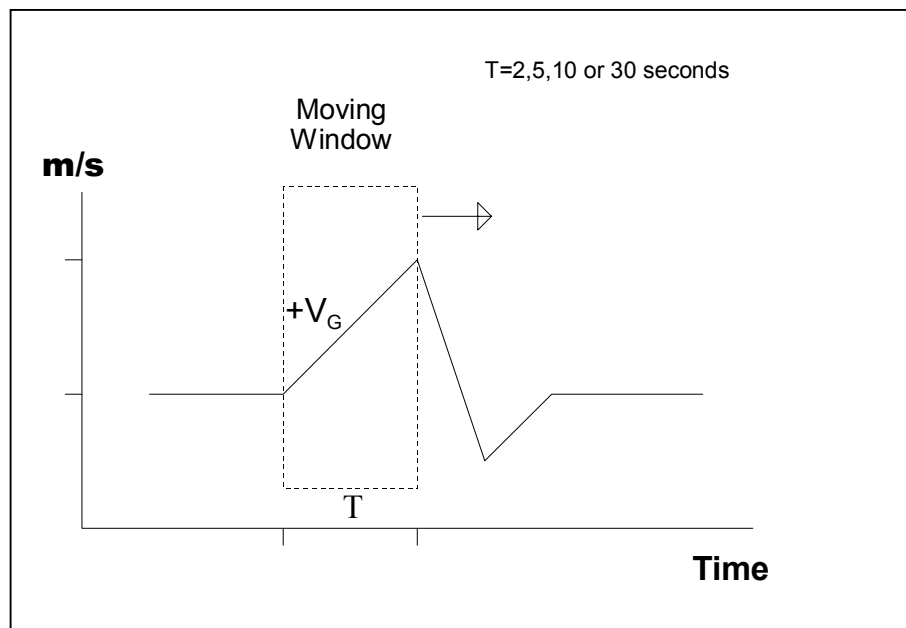


Figure 1: Definition of gust indexing.

Gust [m/s]

Select the range of the positive wind speed gust, $+V_G$ [interval], according to the gust definition given in Reference [2] and illustrated in Figure 1.

Acceleration [m/s/s]

Select the range of the positive wind acceleration gust, $+V_a$ [interval], where

$$V_a = \frac{V_G}{T}$$

Negative gust [m/s]

Select the range of the negative wind speed gust, $-V_G$ [interval], according to the gust definition given in Reference [2] and illustrated in Figure 1.

Negative acceleration [m/s/s]

Select the range of the negative wind acceleration gust, $-V_a$ [interval], where

$$-V_a = \frac{-V_G}{T}$$

Dir change [°]

Select the range of the wind direction gust, D_G [interval]. The definition of the wind direction gust is given in Reference [2].

Dir accel. [°]

Select the size of the wind direction angular velocity gust, D_G/T [interval].

Gust directional index

Select the size of the gust directional index (GDI) [interval]. The definition of the GDI parameter is given in Reference [2].

Note that $1.0 \leq GDI \leq 2.0$ where $GDI=2$ indicates full time correlation between $|max|$ gust and $|max|$ directional change.

3.3.3 Definitions - ten minute wind shear query form**Wind shear [m/s/m]**

Select the size of the *vertical* wind shear [interval]. The wind shear is computed based on *short term* mean wind speed values. The possible time reference periods for this wind speed averaging are: 2, 5, 10 and 30 seconds. The wind shear is calculated as a *linear* shear based on a vertical signal separation, $\Delta h = h_2 - h_1$, provided that $\lambda h \geq 15\text{m}$, $h_1 \geq 15\text{ m}$ and $h_2 \leq 100\text{m}$. Thus

$$\text{Wind shear} = \Delta V / \Delta h \text{ [m/s/m]}, \text{ where}$$

ΔV denotes the wind speed difference [m/s], and Δh is vertical separation of the relevant wind speed observations [m].

Shear factor and shear exponent

Select *shear factor* and *shear exponent* [interval]. The reference period is 10 minutes. The shear factor and the shear exponent define the wind profile. These are determined as a power fit based on 3 or more wind speed measurements from the same meteorological mast (and boom direction). The mean wind speed, V_h (T=10 minutes), at height h is determined from

$$V_h = \text{factor} \times h^{\text{exponent}}$$

Shear monotonic/Shear non-monotonic

Select whether the shear is requested to be monotonic or non-monotonic. Shear monotonic means that the wind speed either increases or decreases constantly with the altitude.

3.3.4 Definitions - matching 10-minute periods (general)

The resulting screen contains links to several pages. The available links are underlined.

Run = 199807311453

Runname with link to run statistics as described in Section 3.2.2.

Ten min = 1

10-minute time series identification numbers [1,2,3,4,5,6], that fulfils the query conditions, with link to the *10- minute statistics*.

Site = test

Site name with reference to the site description.

Speed = 19.4

10-minute mean wind speed [m/s].

Dir = 140

10-minute mean wind direction [deg].

Turb % = 12.7

10-minute turbulence intensity [%].

Gusts = G

Reference to the 10-minute gust report.

Dir change = D

Reference to the 10-minute direction change (direction gust) report.

Shear = S

Reference to the 10-minute shear report.

Shear Fit = F

Reference to the 10-minute shear fits report.

Gust directional index = GDI

Reference to the report on gust directional indices.

3.3.5 Definitions - matching 10-minute periods (10-minute statistics)

Site = test

Reference to site description for the site "test".

Run = 199807311453

Actual *runname*, defined in Section 3.1.

Start = 31-07-98 14:53:00

Start time of time series recording.

Ten min = 1 of 1

Actual 10-minute period number and total number of periods in this particular run.

File = /aspruzza/1997/day126/1503_010.zip

Unique filename as defined in Section 3.2.3.

Frequency = 1.00

Sampling frequency referring to file [Hz].

Packed size = 27684

Size of compressed file [Bytes].

Channel = s11

Channel name with link to signal and instrument information.

Type = s

Signal type according to Table 1.

Freq = 1.0

Sampling frequency referring to channel [Hz].

Height = 33

Instrument height above ground level [m].

Mean = 3.80

Mean value associated with a 10-minute reference time period.

Stdv = 1.18

Standard deviation associated with a 10-minute reference time period.

Min = 0.8

Minimum value associated with a 10-minute reference time period.

Max = 8.3

Maximum value associated with a 10-minute reference time period.

Turbulence = 11.

Turbulence intensity with reference to a 10-minute reference time period [%].

3.3.6 Definitions - matching 10-minute periods (10-minute transient gust events)

Most of the definitions introduced in Section 3.3.2 apply also for this section.

Gust+ = 2.6

Maximum positive wind speed gust referring to the specified gust time extension T [m/s].

Gust- = -4.5

"Maximum" negative wind speed gust referring to the specified gust time extension T [m/s].

Accel+ = 1.3

Maximum positive wind acceleration gust referring to the specified gust time extension T [m/s/s].

Accel- = -2.25

"Maximum" negative wind acceleration gust referring to the specified gust time extension T [m/s/s].

Dir change = 19.8

Maximum absolute change in the wind speed direction referring to the specified gust time extension T [deg].

Dir accel = 9.9

Maximum absolute angular velocity of the wind speed direction referring to the specified gust time extension T [deg/s].

3.3.7 Definitions - matching 10-minute periods (transient 10-minute wind shear events)

Most of the definitions introduced in Section 3.3.3 apply also for this section.

Channel 1 = cup45

"Lower" wind speed channel used in the shear calculation.

Height 1 = 90.0

Height above ground level for "lower" wind speed sensor [m].

Channel 2 = cup90

"Upper" wind speed channel used in the shear calculation.

Height 2 = 90.0

Height above ground level for "upper" wind speed sensor [m].

Period = 2

Data indexing period, T [s], corresponding to the short term wind speed averaging.

Shear+ = 0.03

Maximum shear value referring to a time window extending T seconds [m/s/m].

Shear- = 0.02

Minimum shear value referring to a time window extending T seconds [m/s/m].

3.3.8 Definitions - matching 10-minute periods (wind shear fits)

Most of the definitions used in this report are identical to the previous section.

Mast = 1

Mast number used in the shear fit calculation.

Speeds = 3

Number of wind speed signals used in the shear fit calculations.

Monotonic = T

Characteristics of the wind speeds used in the shear fit computation. T (= True) means that:

- $V_{h1} < V_{h2} < V_{h3} (< V_{h4})$ given that $h1 < h2 < h3 (< h4)$; or
- $V_{h1} > V_{h2} > V_{h3} (> V_{h4})$ given that $h1 < h2 < h3 (< h4)$.

Other combinations result in F (= False).

Shear factor = 6.15 / **Shear exponent** = 0.14

The shear factor and exponent define the average wind profile V_h . The averaging period is 10 minutes. The wind shear is determined according to

$$V_h = \text{factor} \times h^{\text{exponent}} \quad (\text{e.g. } V_{40} = 6.15 \times 40^{0.14} = 10.31 \text{ m/s}).$$

3.3.9 Definitions - matching 10-minute periods (Gust directional index)

Most of the definitions used in this report are identical to the previous section.

Cup = cup45

Channel name associated with the wind speed signal used in the determination of *gust directional index*.

Vane = dir45

Channel name associated with the wind direction signal used in the determination of *gust directional index*.

Period = 5

Reference period on which the determination of *gust directional index* is based [s].

GDI = 1.77

Resulting *gust directional index* value (value range: $1 \leq \text{GDI} \leq 2$).

3.4 Definitions - site/channel selection

The site-channel query form is based on the value of one specific sensor signal. Initially a site is chosen and subsequently the requested channel (including additional statistics) is selected. A search criteria is then established based on the statistics of the chosen channel with the reference time span being equal to the *duration* period. The selection criteria is limited to specification of values between *min* and *max* for maximum 8 items (Mean, Stdv, Min, Max, Range, Stationarity, TI and Corr.TI). An example of the *site-channel selection* procedure is illustrated in Appendix C.

Channel

Defined in Section 3.1.

Mast

Identification number of the meteorological tower(s).

Height

Height above ground level of an instrument [m].

Description

Identification of the channel.

Mean

Mean value of sensor signal.

Stdv

Standard deviation (σ) of the sensor signal.

Min

Minimum value of the sensor signal.

Max

Maximum value of the sensor signal.

Range

Range of the sensor signal.

Stationarity

Stationarity of the signal based on the linear signal trend h ($= h^2/12$), where h is the slope of a linear signal fit.

TI

Turbulence intensity (only valid for speeds>0) [%].

Corr.TI

Trend corrected turbulence intensity (only valid for speeds>0) computed as $100/(U*\sqrt{\sigma^2 - h^2/12})$ [%].

Screening parameter: Stdv

OK for $\sigma > 0$.

Screening Parameter: Range

OK for $|\max - \min| < 6 * \sigma$.

Screening parameter: Signal Spec

OK for min and max inside specified instrument range.

Screening parameter: 4th mom

OK when the normalised 4th order statistical moment, m_4 , is in the range: $(1.5 \leq m_4 \leq 5.0)$.

Screening parameter: 6th mom

OK when the normalised 6th order statistical moment, m_6 , is in the range: $(8 \leq m_6 \leq 20.0)$.

Screening parameter: Spikes

OK if no spikes are detected.

Screening parameter: Under 10 spikes

OK if less than 10 spikes are detected,

Screening parameter: Under 100 Spikes

OK if less than 100 spikes are detected.

Screening parameter: Noise

OK if no noise is detected.

Screening parameter: Tower wake

OK if outside the wake of the meteorological tower.

Screening (e.g. FFTTFFTTFF)

Summarises the values of each of the screening parameters described above (T = OK; F = not OK).

Screening parameter: Fallout

OK if no fallout is detected.

Screening parameter: Misc. error

Bad if miscellaneous errors are detected.

Screening parameter: Errors

OK if no errors are detected.

3.5 Definitions - resource data query form

The resource data query form is used to identify resource data (e.g. 10 minute statistics) from a specific site. Resource data statistics represents a duration period between 10 to 60 minutes. Data can be returned as day, week, month or year files. An example of the "Resource data selection" procedure is illustrated in Appendix D.

Chs

Number of available channels.

Span

Time period with available statistics [month].

Days available

Number of days represented as percentage of the full period.

Channel

Defined in section 3.1.

Type

Channel type defined in Table 1.

Height

Sensor height above ground level [m].

Mast

Number identifying the meteorological tower.

First

Runname for first observation.

Last

Runname for last observation.

File period

Month/year block size for each result file.

Header

If OK, then the resulting resource data file includes a descriptive file header - otherwise the header is omitted.

Zip files

If OK, then all data files are stored as compressed zip-file - otherwise all data files are stored in ASCII format.

File name = [19920101.zip]

Name of [compressed] file containing the 10-minute statistics.

First scan

Start time equal to *runname* of the first *record* in the file.

Last scan

End time equal to *runname* of the last *record* in the file.

Total scans

Total number of available *records* in the file.

File size

File size [Bytes].

Record

Each record includes a *runname* and a number of values, which are comma separated.

4. Data access

For remote users, the wind data is accessible from the ftp server at address 130.226.17.200 (wind-ftp.mek.dtu.dk). This is the first and most direct method of access to the data. All the time series and resource data files are visible but none of the background information, statistics or indexing parameters. For a user requiring data from a specific site at a specific time this is the fastest and most effective access method.

With the large amounts of data available, it is essential to have a search system that can guide a user to the time series relevant for a particular purpose. This is the role of the Web-server, which is the second and principal gateway to the time series data. Here all the background information can be viewed and the statistics and indexing parameters are used to search for data with specific characteristics. After finding relevant data, time series can be downloaded simply by clicking on the file name.

If a user requires many time series or has a slow internet connection, a third, less exotic possibility exists. On request (and for a handling charge), copies of CD-roms can be made and sent by conventional post. The Web-server may still be used to choose the relevant data since the search and browse systems perform well even on dial-in internet connections.

The first two access methods are described in detail in the following sections.

4.1 Downloading using ftp

Access to the time series data with direct ftp is straightforward and efficient but the user must know precisely which data are required. All forms of background information, statistics and indexing parameters reside on the Web-server and are not visible with direct ftp access.

Time series can be obtained in different ways depending on the required number and their physical size:

- 1) The Web-server (<http://www.winddata.com/>) contains a link to the ftp-server, enabling the browser to function as an ftp-client, giving direct access to the time series files. Files downloaded in this way do not preserve the directory structure of the database, unless this discipline is manually imposed by the user.
- 2) Any ftp client program (on any operating system) can be used to access the ftp-server directly at address 130.226.17.200 (wind-ftp.mek.dtu.dk). This is in principle the same as method 1) with the exception that the user must manually log on to the ftp server. At present, anonymous access is permitted with no download quantity limit. Files should be transferred in ASCII format in order to implement correct line termination conversion.
- 3) A hybrid of both Web and direct ftp access is available, giving the advantages of both systems and in addition, automatically preserving the directory structure on download. Data are first identified using either of the Web query systems (described in a following Chapter). The “Files” button is then pressed, displaying a list of all the time series files fulfilling the search criteria. Using the browser File menu, this file-list is transferred to the client (=user). The file-list can be used as input to the (Windows 95/98/NT) utility program DBWIND.EXE (cf. Section 5.1) which creates the necessary local directories and retrieves the data files given in the file-list, operating as a background ftp task.

Resource data can only be obtained through a registered login and using the procedure described in Appendix D, where the statistics could be downloaded after a resource data query.

4.2 Using a Web browser

The principal gateway to the time series data is through a Web browser from which the user can access the wind database Web-server at address <http://www.winddata.com/>. Here the user can view background information and search for data using the query systems.

The design philosophy of this home page is to enable quick access to both the background information and to the database itself. The left frame on the screen picture, which is visible from every page on the server, contains links to additional pages with:

- 1) Welcome.
- 2) Site overview and project descriptions.
- 3) User registration forms.
- 4) FTP-server access to data.
- 5) Input definitions for the data providers.
- 6) Getting started (tutorial and basic definitions).
- 7) Examples.
- 8) Ongoing research projects using the database.
- 9) Software ready for download.
- 10) News with information on the latest updates.

- 11) Status for the database contents (search form on site and setup characteristics).
- 12) Links to other relevant sites.
- 13) Frequently asked questions (questions and answers).
- 14) Exercises (tutorial exercises).

Most of the above listed links are self-explaining and will not be described further here. The most central link on the main frame is to the search system. This link will be described in details in the following sections. Clicking this link opens the login form, which presents two possibilities: login as unregistered or alternatively as registered user. Unregistered entry requires only an e-mail address (no password) and gives access only to the “Simple query” system described in Section 4.3.

For access to the more sophisticated query systems (“Advanced query”, “Site-channel query”, “Resource data query”), the user must first register (by filling out and submitting the registration form) and subsequently receives a password.

4.3 The simple query form

The “Simple query” form is used for identifying, selecting, downloading and handling of measured wind field *time series* online from “Database on Wind Characteristics”. Besides being used for identification and downloading purposes, the “Simple query” form is recommended to establish an overview of available time series before using the more advanced search facilities described in Sections 4.4 and 4.5.

The simple query has been designed as a straightforward and fast tool for finding time series. It contains only the most fundamental parameters (speed, turbulence intensity, direction, terrain and orography type) and uses only the *nominal* run statistics (one speed, one direction and one turbulence intensity value per time series). Despite the simplicity, it is anticipated that the simple query will be able to satisfy the majority of user requests. The data selection form is shown in Figure A.1 in Appendix A.

In order to prevent unnecessarily large network traffic, the user is not permitted to view results from a query until the number of runs are lesser than 500. To enforce this discipline, only the “Count” button is visible until the parameters selected result in a number of time series under this limit. In other words, no other operations will be available until the “Count” button has been pressed and the number of runs are lesser than 500.

Having entered selection parameters resulting in under 500 time series, the user is presented with a further 2 operations; “View” and “Files”:

Pressing “View” results in a list of matching runs together with site name and “nominal” statistics (c.f. Figure A.2 in Appendix A). On this page, site names and run names appear as hyperlinks. Clicking a site name enters the background information viewing system for the appropriate site. Clicking a run name results in a report giving an overview of the run including the run statistics for each channel and the names of the data files (c.f. Figure A.3 in Appendix A). By clicking on the file names, the time series can be directly downloaded.

Pressing “Files” from the query form results in a list of data files fulfilling the search criteria (c.f. Figure A.5 in Appendix A). Time series can be downloaded by clicking on the individual

data file names. Alternatively the file list can be saved locally and all the data files downloaded by using the DBWIND.EXE utility described in Section 5.1.

The operating procedure, constituting the “Simple query” form, is conveniently summarised in the following 15 steps:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select item “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select item “Registered Login”;
- Step 5. Select item 1 – “Simple query”;
- Step 6. Select desired intervals for wind speed/turbulence intensity/wind direction/duration;
- Step 7. Select/disable terrain type/type of orography/site/run;
- Step 8. Press “Count”;
- OPTION 1 -----
- Step 9-1. Press “View” to generate and view a list of matching runs;
- Step 10-1. Select run to get run statistics;
- Step 11-1. Select “p” to plot the time history.
- OPTION 2 -----
- Step 9-2: Press “Files” to get a list of the identified files;
- Step 10-2: Select a “File name” to download the specified file from the ftp-server OR select “download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory).

Note, that guest users (by entering username = email address) can access and use most of the simple query form features. However, download of wind field time series is only possible for registered users.

In addition to the description above use of the “Simple query” form is illustrated by an example in Appendix A.

4.4 The advanced query form

The “Advanced query” form is used for identifying, selecting, downloading and handling of measured wind field *time series* online from “Database on Wind Characteristics”. Besides facilitating in principle the same type of identification (statistics) as the “Simple query” form, the “Advanced query” form offers possibilities for identification and visualisation of records

defined either in terms of gust events or in terms of various *vertical* wind speed profile characteristics.

Thus basically, the “Advanced query” form consists of the three individual forms:

- “Ten min stats”;
- “Transient events”; and
- “Wind shear”.

The structure of the “Advanced query” form is schematically illustrated in Figure 2.

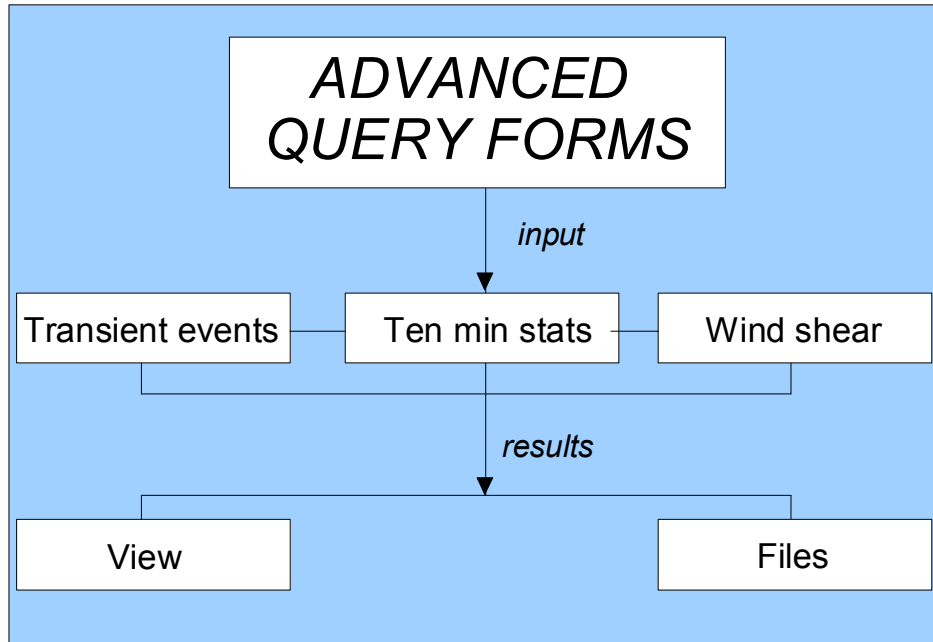


Figure 2: Structure of the "Advanced query" form.

The “Ten min stats” form corresponds in principle to the “Simple query” form. However, contrary to the “Simple query” form, the “Ten min stats” form is based on 10-minute rather than “nominal” run statistics. Thus each channel is represented individually, resulting in a considerable increase in the volume of statistics. Combining several parameters may result in a time consuming query.

The “Transient events” query form encompasses facilities for identification of different types of (one point) gust events such as wind speed gusts², wind acceleration gusts, wind direction gusts and combined wind speed- and wind direction gusts (GDI). All gust findings are based on an overall 10-minute time series reference period combined with a (selectable) gust reference time period (2s, 5s, 10s or 30s).

The “Wind shear” query form is oriented towards identification of different kinds of *vertical* wind speed profiles. The *maximum* (positive as well as negative) vertical wind speed gradient (corresponding to an assumed linear wind speed profile), within a 10-minute reference period, can be identified based on a selectable short term time averaging period (2s, 5s, 10s or 30s).

² The concepts "gust", "shear" and "GDI" are defined in Reference [2].

As for the simple query, the user must first find a combination of selection parameters (c.f. Figures B.2, B.3 and B.10 in Appendix B) giving less than 500 results. Here the results are given as ten minute periods of a run, so one run may well appear several times with a different ten minute period number. Pressing “View” results in a list of ten minute periods, sites or nominal statistics. As for the simple query, site and run names are given as hyperlinks having the same function as before. A ten minute number also appears as a hyperlink. Clicking here opens a report containing the ten minute statistics for all the channels together with links to the data files. At the right hand side of the “View” form are links to reports giving detailed information concerning the indexing parameters (gusts, direction change, shear, shear fit and gust directional index).

Concerning the “Ten min stats” form reference is made to the “Simple query” form described in Section 4.3. The search procedures described in the following are thus restricted to only the “Transient events” form and to the “Wind shear” form.

Note, that only registered users can access and use the "Advanced query" form features, including download of wind field time series.

4.4.1 Transient events

The “Transient events” query form includes a variety of functional analogue gust options, and, although possible, it is *not* recommended to operate with more than one gust search specification at a time. Two or more simultaneous applied gust definitions will result in time series containing all the defined gust types, however, most likely not appearing at the same time instant (some definitions even excludes each other at the same instant!). As a result probably very few (if any) time series will be identified.

The search procedure for identification of transient (gust) events is conveniently summarised in the following 14 steps:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select item “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select item “Registered Login”;
- Step 5: Select item 2 – “Advanced query”;
- Step 6: Select a site in the “Ten min stats” query form as well as a gust/shear time extend period;
- Step 7: Select item “Transient events”;
- Step 8: Select the desired gust characteristics by specifying the appropriate parameter size interval;

- Step 9: Press “Count”;
- OPTION 1 -----
- Step 10.1: Press “View” to generate and view a list of matching ten minute periods;
- Step 11.1:
 - ⇒ Select “Run” to get run statistics (corresponding to run period); OR
 - ⇒ Select “10-min” to get 10-minute statistics; OR
 - ⇒ Select “G” to retrieve wind speed (acceleration) gust results, OR select ”D” to retrieve wind direction gust results, OR select “S” to retrieve vertical mean wind shear results, OR select “F” to retrieve shear fit results, OR select “GDI” to retrieve wind gust direction index results. Note, that all possible retrieved results relate to time series identified by the *gust type* defined in Step 8;
- Step 12.1: Select “P” to plot the time history (only possible if “G” or “D” is selected in 11.1);
- OPTION 2 -----
- Step 10.2: Press “Files” to get a list of the identified files;
- Step 11.2: Select a “File name” to download the specified file from the ftp-server OR select “Download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory; cf. Chapter 5);

In Appendix B the description above on transient events search profiles is supplemented by an example of identification of a particular gust event.

4.4.2 Wind shear

The “Wind shear” query form includes a variety of functional options, and, although possible, it is *not* recommended to operate with more than one shear specification at a time.

The search procedure is summarised in the following 13 steps:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select item “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select item “Registered Login”;
- Step 5: Select item 2 - “Advanced query”;
- Step 6: Select a site in the “Ten min stats” query form as well as a gust/shear time extend period;
- Step 7: Select item “Wind shear”;

- Step 8: Select the desired shear size by specifying the appropriate shear [m/s/m] interval;
- Step 9: Press “Count”;
- OPTION 1 -----
- Step 10.1: Press “View” to generate and view a list of matching ten minute periods;
- Step 11.1:
 - ⇒ Select “Run” to get run statistics (corresponding to run period); OR
 - ⇒ Select “10-min” to get 10-minute statistics; OR
 - ⇒ Select “S” to retrieve vertical mean wind shear results, OR select “G” to retrieve wind speed (acceleration) gust results, OR select “D” to retrieve wind direction gust results, OR select “F” to retrieve shear fit results, OR select “GDI” to retrieve wind gust direction index results. Note, that all possible retrieved results relate to time series identified by the *shear type* defined in Step 8;
- OPTION 2 -----
- Step 10.2: Press “Files” to get a list of the identified files;
- Step 11.2: Select a “File name” to download the specified file from the ftp-server OR select “Download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory; cf. Chapter 5);

In Appendix C the description above on vertical wind shear search profiles is supplemented by an example of identification of a particular wind shear event.

4.5 The site-channel query form

In analogy with the “Simple query” form and the “Advanced query” form, the “Site-channel query” form is used for identifying, selecting, downloading and handling measured wind field time series online from “Database on Wind Characteristics”. However, contrary to the “Simple query” form and the “Advanced query” form, the “Site-channel query” form is intended for application in identifying and visualising the properties of recordings associated with a *particular* measuring channel.

Note, that only registered users can access and use the “Site-channel” query form features, including download of wind field time series.

Use of the “Site-channel” search profile is summarised in the following 18 steps:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select item “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select item “Registered Login”;

- Step 5: Select item 3 – “Site-channel”;
- Step 6: Select a site;
- Step 7: Select a channel;
- Step 8: Select the desired interval for the particular channel characteristics (Mean/Stdv/Min/Max/Range(=Max-Min)/Stationarity(=variance contribution from trend)/TI (turbulence intensity)/Corr. TI (trend corrected turbulence intensity)).

Note: last 2 items are only active for wind speed channels;

- Step 9: Select quality level by activating/deactivating the respective available error-flags;
- Step 10: Press “Count”;
----- OPTION 1 -----
- Step 11.1: Press “View” to generate and view a list of matching runs;
- Step 12.1: Select “Run” to get run statistics;
- Step 13.1: Select “P” to plot the time history;
----- OPTION 2 -----
- Step 11.2: Press “Files” to get a list of the identified files;
- Step 12.2: Select a “File name” to download the specified file from the ftp-server OR select “Download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBwind.exe” located in the software directory; cf. Chapter 5);
----- OPTION 3 -----
- Step 11.3: Press “Plot” in order to define a plot type;
- Step 12.3: Select the desired x-axis and y-axis parameters (*Note: all possible parameter options are characteristics related to the selected channel*);
- Step 13.3: Press “Plot” to generate an online plot.

In Appendix D an example illustrating the “Site-channel” search form is given.

4.6 The resource data query form

The “Resource data query” form is used to online identify, select, handle and download resource data stored in “Database on Wind Characteristics”. Contrary to the time series data, the resource data are represented only in terms of statistical quantities (typically mean values, standard deviation values, maximum values, minimum values) each related to (high frequency) sampled records with a typical temporal extension between 1 and 30 minutes.

Note, that only registered users can access and use the “Resource data query” form features, including download of resource data.

The “Resource data query” form can be summarised in the following 15 steps:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select item “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select item “Registered Login”;
- Step 5. Select item 4 - “Resource data”;
- Step 6. Select the requested site among the available resource data sites;
- Step 7. Select/disable channels to be downloaded;
- Step 8. Enter start of requested time period (=“First”);
- Step 9. Enter end of requested time period (=“Last”);
- Step 10: Select “File period” (1 day or 1 week or 1 month or 1 year);
- Step 11: Select/disable header (important for identifying the selected data subsequently);
- Step 12: Select/disable “Zip files” (especially important for slow speed data connections);
- Step 13: Select “Get Data” in order to retrieve the selected data from the database;
- Step 14: Select “*.zip” in order to download the specified data to the client (YOUR) workstation;
- Step 15: Unzip the downloaded data files.

Appendix D illustrates the procedure outlined above by an example.

5. Additional tools

This group of features encompasses a tool to ease download of time series data, a data analyses tool and a tool applicable for download of run statistics. The tool designed for download of run statistics is implemented as an integrated part of the database, whereas the two remaining features are implemented in software packages available for download from the Web-site (item “Software” in the main menu) and subsequent installation on the users computer.

5.1 Tool for download of time series

The tool DBWIND.EXE is available for MS-WINDOWS users only. The programme is used to perform automatic downloading of a limited number (<500) of time series from the ftp-server preserving the correct file structure as defined on the ftp-server.

To use DBWIND.EXE an input file containing the relevant time series file names is required. This input file can be generated from the “Simple query”, the “Advanced query” or the “Site-channel query” forms as described in Section 4.3-4.5.

The procedure for download of time series using DBWIND.EXE is summarised below:

- Step 1: Download “DBWIND.ZIP” from “<http://www.winddata.com/software>”;
- Step 2: Uncompress DBWIND.ZIP to “c:\Program Files\database\DBWIND.EXE”;
- Step 3.1: Prepare working directories and the relevant input file list;
- Step 3.2: Load the “DBWIND.EXE” program;
- Step 4.1: Enter working directory (optional);
- Step 4.2: Enter data drive letter for transferred time series;
- Step 4.3: Select file with list of filenames;
- Step 4.4: Enter UserID to ftp-server;
- Step 4.5: Enter Password to ftp-server;
- Step 5: Download in progress;
- Step 6: Result; number of files downloaded specified as i / n with “i” being the number of files transferred out of “n” possible. Obviously, if “i” equals “n” the performed downloading is successful.

All the selected files are stored on the USERS computer in a directory with the following structure: <specified drive>:\<site_name>\<year_no>\<day_no>.

5.2 DANAP - a tool for time series analysis

The data analyses package DANAP is available for MS-WINDOWS applications from the Web-server. In addition, a HP-Unix version is available on request (winddata@et.dtu.dk). The DANAP package is used for data analysis of time series data. At present the package includes tools for calculation of statistics, probability functions, power spectra and correlation functions. The package is under continuous development and will eventually include a broad variety of analysis tools applicable for time series analysis.

The procedure for installing the DANAP package is outlined below. A detailed instruction for use is available online (DANAP.PDF).

- Step 1: Download “DANAP.EXE” from “<http://www.winddata.com/software>”;
- Step 2: Execute “DANAP.EXE” (the package is self installing and includes documentation);
- Step 3: Load “DANAP.EXE”. Detailed user instruction is available in either DANAP.HTML, which is included in the installation, or in DANAP.PDF stored on the Web-server.

5.3 Download of run statistics

A site specific part of the run statistics is available for each site on the ftp-server. The statistics is stored in both PARADOX (*.db) and in MS-ACCESS (*.mdb) tables together with an information file (in ASCII format) and can be used for offline analysis of the calculated statistics. The contents of the available tables are:

- 1) Channels properties (cf. name, type and level);
- 2) Addchannel contains additional channel information (cf. name, type and height);
- 3) Runs (cf. date, time, duration and file name for each run);
- 4) Stats (run statistics - cf. mean, maximum, minimum and standard deviation for each channel);
- 5) Screen (screening properties for each channel);
- 6) Addstats (statistical values - cf. mean, minimum, maximum and standard deviation for additional channels);

The procedure for retrieving and analysing the MS-ACCESS and PARADOX tables containing the run statistics is summarised below:

- Step 1: Connect to ftp-server “130.226.17.200”, using UserID and Password (identical to the ones from the user registration);
- Step 2: Select site (i.e. Cd (command) <site>);
- Step 3: Get “<site>.zip” (cf. get “midgrund.zip”);
- Step 4: Uncompress “<site>.zip”;

- Step 5: Open “site.mdb”, using MS-ACCESS, or “channels.db”, “addchannels.db”, “runs.db”, “stats.db”, “addstats.db”, “screen.db” using Paradox.

All subsequent analysis after “Step 5” are performed by the user in the MS-ACCESS or PARADOX environment.

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Appendix A: Example - Simple query form

The procedure described in Section 4.3 is illustrated by an example, where time series from the “midgrund” site, corresponding mean wind speeds above 15 m/s, are retrieved from the database.

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select “Registered Login”;
- Step 5: Select “Simple Query” among the available possibilities (cf. Table A.1);

Item	Description
1. <u>Simple Query</u>	Access to simple query form
2. <u>Advanced Query</u>	Access to advanced query form
3. <u>Site - channel</u>	Access to search values for a channel
4. <u>Resource data</u>	Access to resource data
5. <u>Direct FTP- access</u>	Direct access to the FTP-server, using the Web-interface

Table A.1: Available search facilities.

- Step 6: Specify “Wind speed > 15 m/s” and “Site = midgrund” (cf. Figure A.1);
- Step 7: Press “Count” (cf. Figure A.1);

[Finding data](#)

Simple data selection form

	<i>min</i>	<i>max</i>		
Wind speed [m/s]	<input type="text" value="15"/>	<input type="text"/>	terrain	<input type="text" value="All"/>
Turbulence intensity [%]	<input type="text"/>	<input type="text"/>	orography	<input type="text" value="All"/>
Wind direction [deg]	<input type="text"/>	<input type="text"/>	site	<input type="text" value="midgrund"/>
Duration [sec]	<input type="text"/>	<input type="text"/>	run	<input type="text"/>

Figure A.1: This query results in 6 runs with nominal speed above 15 m/s recorded at site=midgrund”.

Note: Browsing of run statistics and downloading of files is limited to 500 files per query, however all time series can be downloaded directly from the ftp-server (130.226.17.200).

A.1 View results

- Step 9-1: Press “View” to generate and view a list of matching runs (cf. Figure A.2 where all 6 matching runs are given including links to the statistics for each run (header “Run”) and the associated site information (header “Site”) are given);

Matching runs						page 1 of 1
<u>Run</u>	<u>Site</u>	<u>Speed</u>	<u>Dir</u>	<u>T.I.%</u>	<u>Duration</u>	
199710041130	midgrund	15.8	292	15	1800	
199710050230	midgrund	15.2	290	13	1800	
199711030330	midgrund	15.3	356	9	1800	
199711030400	midgrund	15.5	359	10	1800	
199711030700	midgrund	15.4	358	9	1800	
199801042029	midgrund	15.2	157	9	1800	

Figure A.2: 6 matching runs with nominal speed above 15 m/s recorded at “site=midgrund”.

- Step 10-1. Select “199710041130” to get run statistics for the channels available in this particular run (cf. Figure A.3);

Run statistics of time series channels										Additional statistics
Site: midgrund					Run: 199710041130					
Start: 04-10-1997 11:30:01					Duration: 1800.00					
File		Frequency			Packed size					
\midgrund\1997\day277\1130_050.zip		5.00			89971					
Channel	Type	Freq	Height	Mean	Stdv	Min	Max	Turb %		
ws45	P	s	5.0	50	16.70	2.52	10.2	23.4	15.1	
ws30	P	s	5.0	30	16.06	2.38	9.1	22.5	14.8	
ws10	P	s	5.0	10	14.57	2.14	8.8	22.1	14.7	
wd30	P	d	5.0	30	291.60	5.09	268.9	312.0	0.0	

Figure A.3: Run statistics for “run=199710041130”.

Note: The run statistics page (Figure A.3) includes links to:

- 1) The site information “[midgrund](#)”;
- 2) File “[\midgrund\1997\day277\1130_050.zip](#)”;
- 3) Channels information “[ws45](#)”, “[ws30](#)”, “[ws10](#)” and “[wd30](#)”;
- 4) On-line plot of each channel “[p](#)”.

Statistics for 3 additional channels are available from “[Additional statistics](#)”.

- Step 11-1. Select “p” to plot time history for “channel=ws45”;

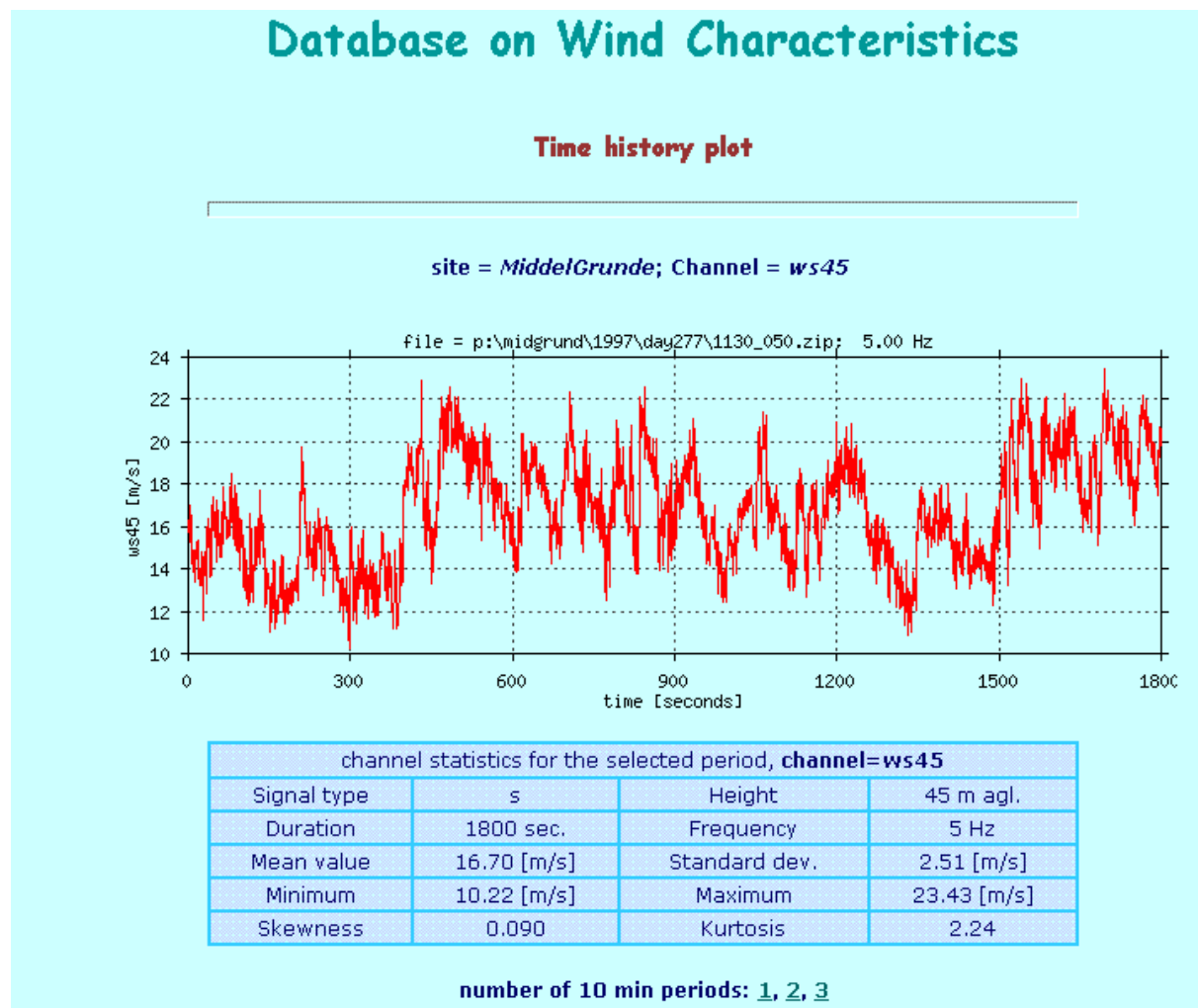


Figure A.4: Time series plot for “channel = ws45”.

Plots of identified time series are created on-line together with the statistics. For time series extending more than 10 minutes in time, a zoom facility is available down to a 10 minute level. F. ex. for a 30-minute statistic situation the 10-minute time series zoom views are activated by pressing “1”, “2”, “3”, respectively (cf. Figure A.4).

A.2 Download results

- Step 9-2: Press “Files” to get a list of the identified files (cf. Figure A.5);

File list for matching runs (6 files, 0.48 MB)	
download text copy of file list	
File name	Packed size
\midgrund\1997\day277\1130_050.zip	89971
\midgrund\1997\day278\0230_050.zip	90331
\midgrund\1997\day307\0330_050.zip	85021
\midgrund\1997\day307\0400_050.zip	84975
\midgrund\1997\day307\0700_050.zip	84620
\midgrund\1998\day004\2029_050.zip	64109

Figure A.5: File list for matching runs - available for download from the ftp-server.

- Step 10.2: At this stage two alternatives for downloading of data are offered:
1. Select “download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory);
 2. Select File name = “\midgrund\1997\day277\1130_050.zip” to download this particular file from the ftp-server to YOUR workstation.

Note: All time series are compressed with PkZip.exe. PkUnZip.exe can be used to uncompress the compressed files (MS-DOS, WIN95, WIN98, WINNT & W2K). PkUnZip.exe is available from the software library.

Appendix B: Example - Advanced query form

B.1 Transient events

The procedure described in Section 4.4 is illustrated by an example, in which gusts (gust time extension assumed equal to 5 seconds) larger than 8 m/s are identified from records originating from site = “midgrund”. Subsequently, one of the identified time series is visualised using the database online time series plotting facilities.

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select “Registered Login”;
- Step 5: Select “Advance query” among the available possibilities (cf. Table A.1);
- Step 6: Select the desired site (=“midgrund”) among the available sites (cf. Figure B.1);

Ten minute stats

	<i>min</i>	<i>max</i>
Wind speed [m/s]	<input type="text"/>	<input type="text"/>
Turbulence intensity [%]	<input type="text"/>	<input type="text"/>
Wind direction [deg]	<input type="text"/>	<input type="text"/>
Sensor height [m]	<input type="text"/>	<input type="text"/>

site :

Run name :

Figure B.1: Advanced query; selection of site and gust shear period.

- Step 7: Press “Transient events” (cf. Figure B.1);
- Step 8: Enter desired wind speed gust size (>8 m/s) (cf. Figure B.2);
- Step 9: Press “Count” (cf. Figure B.2);

Transient events

	<i>min</i>	<i>max</i>		<i>min</i>	<i>max</i>
Gust [m/s]	<input style="width: 50px;" type="text" value="8"/>	<input style="width: 50px;" type="text"/>	Negative gust	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>
Acceleration [m/s/s]	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>	Negative accel	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>
Dir change [°]	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>			
Dir accel. [°/s]	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>			
Gust directional index	<input style="width: 50px;" type="text"/>	<input style="width: 50px;" type="text"/>			

Ten minute stats

Wind shear

5

▼

gust and shear period [secs]

Count

9

View

Files

Figure B.2: This query results in 9 matching 10-minute periods each containing at least one gusts, larger than 8 m/s.

Note: Browsing of results downloading of files is limited to a maximum of 500 gusts per query.

B.1.1 View statistics

- Step 10.1: Press “View” to get a list of matching ten minute periods (cf. Figure B.3);

Matching ten minute periods						page 1 of 1				
Run	10 min	Site	Speed	Dir	TI%	symbol def.				
199710041130	2	midgrund	15.8	291	14.9	G	D	S	F	Gdi
199710041130	3	midgrund	15.8	291	14.9	G	D	S	F	Gdi
199710041230	1	midgrund	13.8	290	13.9	G	D	S	F	Gdi
199710041300	1	midgrund	13.9	289	14.2	G	D	S	F	Gdi
199710041400	1	midgrund	14.8	288	15.5	G	D	S	F	Gdi
199710042200	3	midgrund	11.2	266	15.0	G	D	S	F	Gdi
199710050130	3	midgrund	14.4	280	11.3	G	D	S	F	Gdi
199710050230	2	midgrund	15.2	290	13.0	G	D	S	F	Gdi
199801050959	2	midgrund	14.0	246	13.7	G	D	S	F	Gdi

Figure B.3: Matching 10 minute periods with containing a wind speed gust larger than 8 m/s, measured at site = “midgrund”.

Note: this is the key page for all advanced queries which lists all the matching ten minute periods and include links to:

- 1) *Run statistics,*
 - 2) *Ten minute statistics,*
 - 3) *Site description,*
 - 4) *Wind speed gust size (G),*
 - 5) *Wind direction changes (D),*
 - 6) *Shear values (S),*
 - 7) *Shear fit (F),*
 - 8) *Gust directional index (GDI).*
- Step 11.1.2: Select ten minute statistics “10 min” for period 2 = “2” and run = “199710041130” (cf. Figure B.3 and Figure B.4);

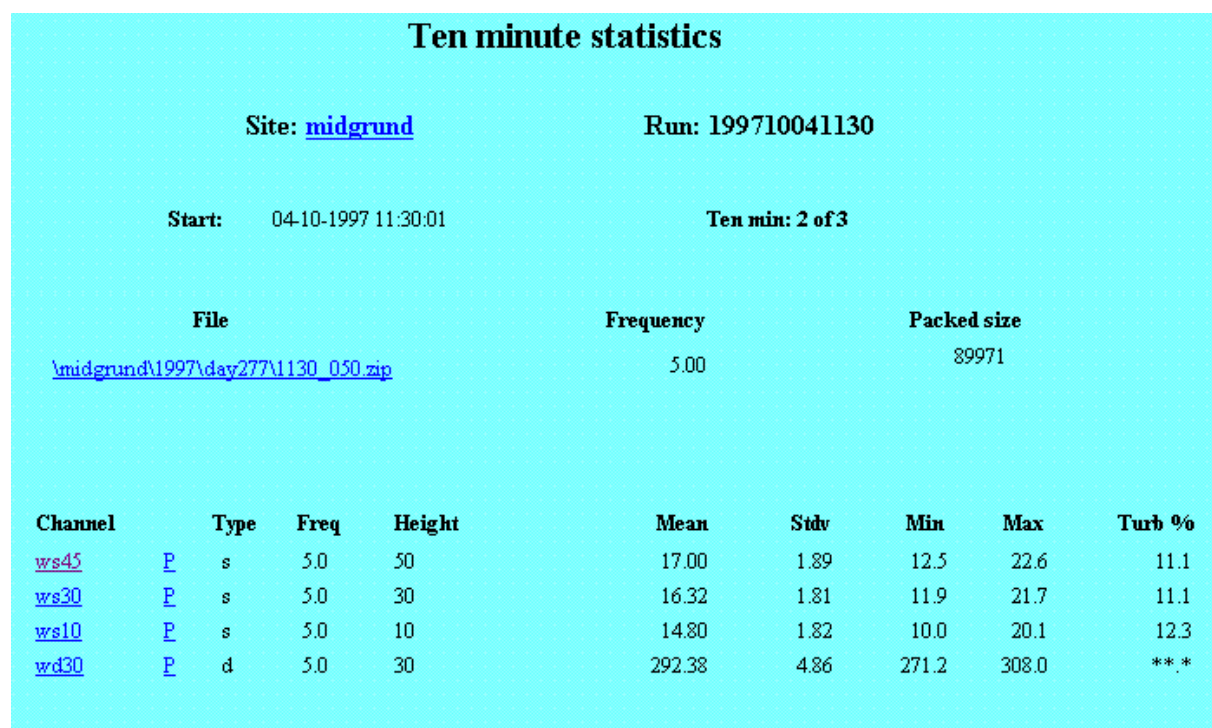


Figure B.4: Ten minute statistics for period 2, run = “199710041130”; site = “midgrund”.

- Step 11.1.3: Select “G” for run = “199710041130” to list and view the identified wind speed gust characteristics (cf. Figure B.4 and Figure B.6);

Ten minute speed gusts and accelerations							
Site: <u>midgrund</u>				Run: 199710041130			
Start: 04-10-1997 11:30:01				Ten min: 2 of 3			
Channel		Height	Period	gust+	gust-	accel+	accel-
<u>ws45</u>	<u>P</u>	50.0	2	6.7	-5.8	3.33	-2.90
<u>ws30</u>	<u>P</u>	30.0	2	4.8	-3.7	2.41	-1.86
<u>ws10</u>	<u>P</u>	10.0	2	6.5	-5.8	3.24	-2.90
<u>ws45</u>	<u>P</u>	50.0	5	8.3	-5.5	1.66	-1.09
<u>ws30</u>	<u>P</u>	30.0	5	7.4	-5.9	1.48	-1.18
<u>ws10</u>	<u>P</u>	10.0	5	5.6	-5.3	1.12	-1.06
<u>ws45</u>	<u>P</u>	50.0	10	7.9	-5.8	0.79	-0.58
<u>ws30</u>	<u>P</u>	30.0	10	7.7	-6.8	0.77	-0.68
<u>ws10</u>	<u>P</u>	10.0	10	6.6	-5.9	0.66	-0.59
<u>ws45</u>	<u>P</u>	50.0	30	6.9	-6.6	0.23	-0.22
<u>ws30</u>	<u>P</u>	30.0	30	6.8	-7.7	0.23	-0.26
<u>ws10</u>	<u>P</u>	10.0	30	8.1	-6.8	0.27	-0.23

Figure B.5: Positive and negative wind speed and wind speed acceleration gusts for run = “199710041130” measured at site = “midgrund”.

Each line in the generated survey (illustrated in Figure B.5) contains channel identification, sensor height, gust reference period, the gust size and the wind speed acceleration gust size.

- Step 12.1. Select “P” to plot the time history for “channel=ws45” (cf. Figure B.5 and Figure B.6);

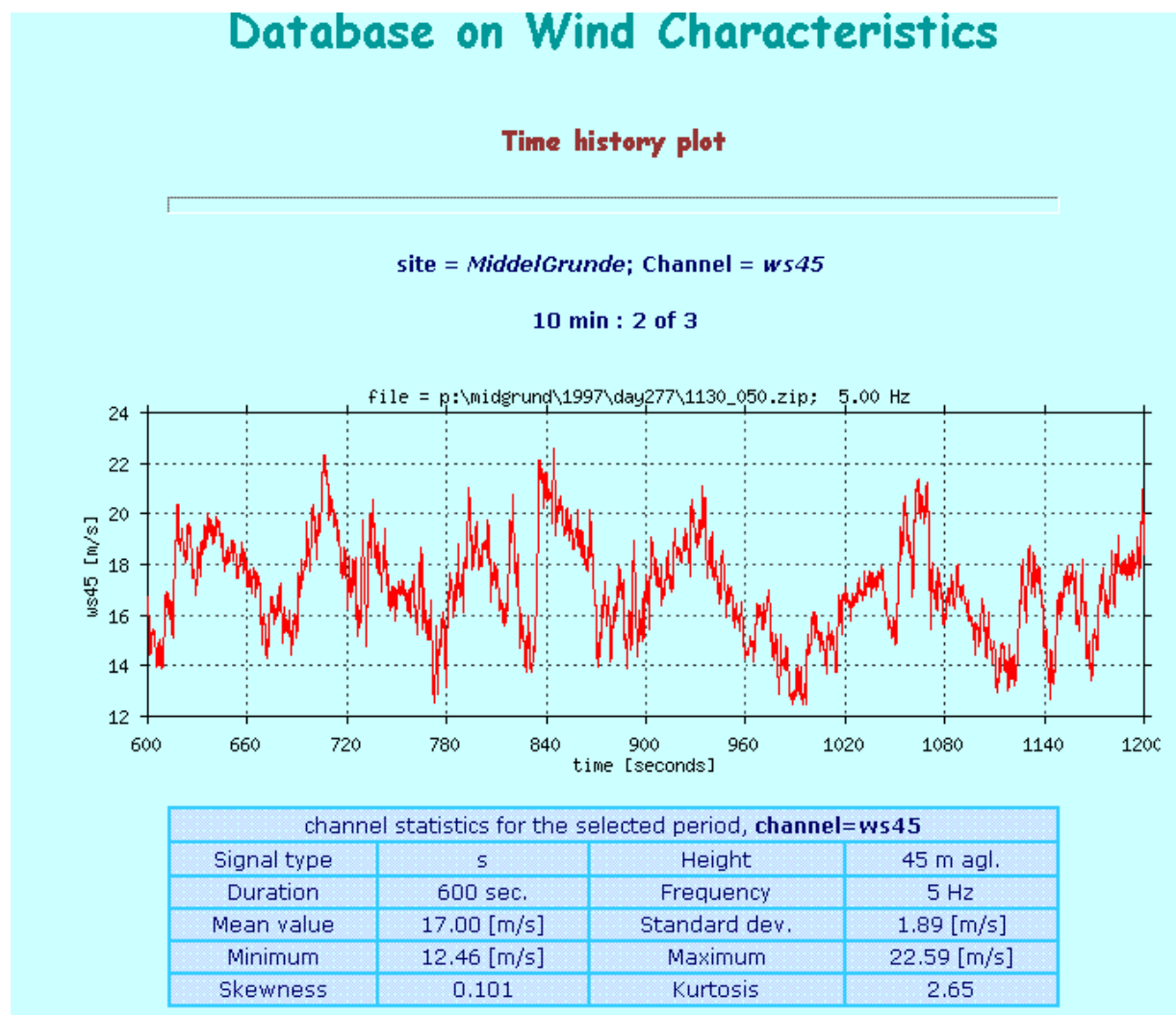


Figure B.7: Time series plot of channel = “ws45”.

The plot in Figure B.6 contains a wind speed gust larger than 8 m/s occurring at t=830-840 sec.

Note: plots of identified time series are created on-line together with the statistics.

B.1.2 Download results

- Step 10.2: Press “Files” to get a list of the files containing the requested gusts (cf. Figure B.2 and Figure B.7);

File list for matching runs (8 files, 0.69 MB)	
download text copy of file list	
File name	Packed size
\midgrund\1997\day277\1130_050.zip	89971
\midgrund\1997\day277\1230_050.zip	90321
\midgrund\1997\day277\1300_050.zip	90729
\midgrund\1997\day277\1400_050.zip	90612
\midgrund\1997\day277\2200_050.zip	91266
\midgrund\1997\day278\0130_050.zip	89893
\midgrund\1997\day278\0230_050.zip	90331
\midgrund\1998\day005\0959_050.zip	91800

Figure B.7: File list for matching runs available for download from the ftp-server.

- Step 11.2: At this stage two alternatives for downloading of data are offered (cf. Figure B.7):
 1. Select “download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory);
 2. Select File name = “\midgrund\1997\day277\1130_050.zip” to download this particular file from the ftp-server to YOUR workstation (the other files on the list can of course be downloaded analogues).

Note: All time series are compressed with PkZip.exe. PkUnZip.exe can be used to uncompress the compressed files (MS-DOS, WIN95, WIN98, WINNT & W2k). PkUnZip.exe is available from the software library.

B.2 Wind shear

The example illustrates how to identify wind shear. It is based on time series from site = “OakCreek”, sensor height >40 m, wind speed > 10 [m/s], shear = 0.25 [m/s/m] and shear extension equal to 10 seconds. The first 5 steps are identical to the steps described in Section B.1 Transient events.

- Step 6: Select the desired site = “Oakcreek”; wind speed > 10 m/s and height > 40 m (cf. Figure B.8);

Ten minute stats

	<i>min</i>	<i>max</i>	
Wind speed [m/s]	<input type="text" value="10"/>	<input type="text"/>	
Turbulence intensity [%]	<input type="text"/>	<input type="text"/>	
Wind direction [deg]	<input type="text"/>	<input type="text"/>	
Sensor height [m]	<input type="text" value="40"/>	<input type="text"/>	
site :	<input style="border: 1px solid black;" type="text" value="oakcreek"/>		
Run name :	<input type="text"/>		

Transient events

Wind shear

10

gust and shear period [secs]

Count

View

Files

Figure B.8: Advanced query; selection of site, wind speed interval, channel height and gust and shear period.

- Step 7: Press “Wind shear” (cf. Figure B.8);
- Step 8: Select the desired shear size 0.25 m/s/m (cf. Figure B.9);
- Step 9: Press “Count” (cf. Figure B.9);

Wind shear

	<i>min</i>	<i>max</i>		<i>min</i>	<i>max</i>
Wind shear [m/s/m]	<input type="text" value="0.25"/>	<input type="text"/>	Negative shear	<input type="text"/>	<input type="text"/>
Shear factor	<input type="text"/>	<input type="text"/>			
Shear exponent	<input type="text"/>	<input type="text"/>			
<input type="checkbox"/> Shear monotonic <input type="checkbox"/> Shear non-monotonic					

Ten minute stats

Transient events

Count

View

Files

15

10

gust and shear period [secs]

Figure B.9: This query results in 15 matching periods, each containing at least one shear value larger than 0.25 m/s/m.

Note browsing of results and downloading is limited to a maximum of 500 values per query.

B.2.1 View statistics

- Step 10.1: Press “View” to generate and view a list of matching ten minute periods (cf. Figure B.9);

page 1 of 1

Run	10 min	Site	Speed	Dir	TI%	symbol def.				
199901200431	1	oakcreek	14.6	309	20.7	G	D	S	F	Gdi
199901200731	1	oakcreek	16.0	297	17.9	G	D	S	F	Gdi
199901200801	1	oakcreek	18.1	306	18.4	G	D	S	F	Gdi
199903310330	1	oakcreek	15.0	315	20.7	G	D	S	F	Gdi
199905030350	1	oakcreek	22.6	330	13.0	G	D	S	F	Gdi
199905030520	1	oakcreek	21.5	328	11.8	G	D	S	F	Gdi
199905030630	1	oakcreek	17.0	325	19.8	G	D	S	F	Gdi
199905031010	1	oakcreek	14.0	319	25.1	G	D	S	F	Gdi
199905031110	1	oakcreek	13.5	317	24.2	G	D	S	F	Gdi
199905031150	1	oakcreek	17.6	320	20.6	G	D	S	F	Gdi
199905031210	1	oakcreek	21.5	322	14.9	G	D	S	F	Gdi
199905031330	1	oakcreek	21.5	323	16.5	G	D	S	F	Gdi
199905031350	1	oakcreek	20.3	318	19.7	G	D	S	F	Gdi
199905031400	1	oakcreek	20.2	322	21.0	G	D	S	F	Gdi
199905031520	1	oakcreek	22.0	324	18.0	G	D	S	F	Gdi

Figure B.10: Matching 10 minute periods with shear larger than 0.25 m/s.

- Step 11.1.1: Select “Run” to get run statistics (corresponding to run period, cf. Figure B.10) ;
- Step 11.1.2: Select “10-min” to get 10-minute statistics (cf. Figure B.10);
- Step 11.1.3: Select “S” to retrieve vertical mean wind shear results (cf. Figure B.10);

Ten minute shears						
Site: oakcreek				Run: 199905031330		
Start: 03-05-1999 13:30:05				Ten min: 1 of 1		
Channel 1	Height 1	Channel 2	Height 2	Period	Shear	
					max	min
m2_ws_50	50.3	m2_ws_79	79.3	2	0.41	-0.21
m2_ws_50	50.3	m2_ws_79	79.3	5	0.39	-0.18
m2_ws_50	50.3	m2_ws_79	79.3	10	0.28	-0.16
m2_ws_50	50.3	m2_ws_79	79.3	30	0.10	-0.09
m1_ws_50	50.3	m1_ws_79	79.3	30	0.12	-0.05

Figure B.11: Measured shear values at different heights for run="199905031330".

Note: the shear values for different gust and shear periods are listed on Figure B.11 and the time series of matching runs are available from the ftp-server (cf. Figures B.8 and B.9).

B.2.2 Download results

- Step 10.2: Press "Files" to get a list of the files containing the requested gusts (cf. Figure B.2 and Figure B.10);

File list for matching runs (8 files, 0.69 MB)	
download text copy of file list	
File name	Packed size
\midgrund\1997\day277\1130_050.zip	89971
\midgrund\1997\day277\1230_050.zip	90321
\midgrund\1997\day277\1300_050.zip	90729
\midgrund\1997\day277\1400_050.zip	90612
\midgrund\1997\day277\2200_050.zip	91266
\midgrund\1997\day278\0130_050.zip	89893
\midgrund\1997\day278\0230_050.zip	90331
\midgrund\1998\day005\0959_050.zip	91800

Figure B.12: File list for matching runs available for download from the ftp-server.

- Step 11.2: At this stage two alternatives for downloading of data are offered (cf. Figure B.12):
1. Select “download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory);
 2. Select File name = “\midgrund\1997\day277\1130_050.zip” to download this particular file from the ftp-server to YOUR workstation (the other files on the list can of course be downloaded analogues).

Note: All time series are compressed with PkZip.exe. PkUnZip.exe can be used to uncompress the compressed files (MS-DOS, WIN95, WIN98, WINNT & W2k). PkUnZip.exe is available from the software library.

Appendix C: Example - Site-channel query form

Use of the “Site-channel query” form described in Section 4.5 is illustrated by an example, where mean wind speeds above 11 m/s are identified for channel = “ws45” (measured 45 m above sea level) at the “midgrund” site. One of the identified time series is visualised using the database online time series plotting facilities. Subsequently the downloading facilities are illustrated, and finally the power density function of the identified mean wind speeds are established. The procedure is as follows:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: Select “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select “Registered Login”;
- Step 5: Select “Site-Channel” among the available possibilities (cf. Table A.1);
- Step 6: Select the desired site (= “midgrund”) among the available sites (cf. Figure C.1);
- Step 7: Select desired channel (= “ws45”) among the available channels (cf. Figure C.2);

Note: Site = “midgrund” is represented with 4 (primary) channels and 3 additional channels.

The four (primary) channels are available as raw measurements, sampled at 5 Hz, while the additional channels are available only in terms of statistical quantities (mean, standard deviation, minimum and maximum) corresponding, for this particular example, to a time period extending 1800 seconds.

Select a site:

Site	Country	Orography	Terrain	Cups	Sonics	Props	Hours
abisko	Sweden	mountain	ice	0	0	0	230
alsvik	Sweden	flat	coastal	16	0	0	17500
andros	Greece	mountain	pastoral	6	0	0	625
aspruzza	Italy	mountain	pastoral	1	0	1	542
cabauw	the Netherlands	flat	pastoral	0	0	1	49
clape	France	hill	scrub	0	1	1	242
ecn	the Netherlands	flat	coastal	9	0	0	49
emden	Germany	flat	coastal	3	0	0	781
hornsrev	Denmark	flat	offshore	0	1	0	773
jwe	Germany	flat	rural	3	0	0	344
kwkoog	Germany	flat	coastal	20	0	1	4
lamme	Denmark	flat	pastoral	9	1	0	663
lavrio	Greece	mountain	pastoral	4	2	0	759
lyse	Sweden	mountain	coastal	1	0	0	3355
maglarp	Sweden	flat	rural	0	0	0	41
marsta	Sweden	flat	rural	0	0	0	0
midgrund	Denmark	flat	offshore	3	0	0	2075
nasudden	Sweden	flat	coastal	4	0	0	3069
ntkl500	Denmark	flat	coastal	2	0	0	151
oakcreek	US	hill	scrub	8	2	0	1825
roedsand	Denmark	flat	offshore	3	1	0	619
sorge	Portugal	mountain	coastal	1	1	0	5
ski	Norway	hill	coastal	0	0	0	13174
skyv27	US	hill	scrub	2	2	0	164
skyv39	US	hill	scrub	3	2	0	138
sle	Norway	flat	coastal	0	0	0	3756
sprogoe	Denmark	flat	coastal	3	1	0	527

Figure C.1: Extract (“upper” part) of available sites in the database.

Signals from site: midgrund [additional statistics](#)

Channel	Mast	Height	Description
ws10	1	10.0	wind speed from cup or propellor
wd30	1	30.0	wind direction
ws30	1	30.0	wind speed from cup or propellor
ws45	1	50.0	wind speed from cup or propellor

Figure C.2: Available (primary) channels at site = “midgrund”.

- Step 8: Select desired intervals of channel characteristics (mean wind speed > 11 m/s), cf. Figure C.3;
- Step 9: Specify the requested data quality by activating/deactivating the available error flags (cf. Figure C.3);

midgrund, ws45

	min	max		
Mean	<input type="text" value="11"/>	<input type="text"/>	<input type="checkbox"/> stdv OK	<input type="checkbox"/> stdv BAD
Stdv	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> range OK	<input type="checkbox"/> range BAD
Min	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> IN signal spec	<input type="checkbox"/> OUT signal spec
Max	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> 4th mom OK	<input type="checkbox"/> 4th mom BAD
Range	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> 6th mom OK	<input type="checkbox"/> 6th mom BAD
Stationarity	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> NO spikes	<input type="checkbox"/> spikes !
Turbulence	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Under 10 spikes	<input type="checkbox"/> Over 10 spikes
Corrums. TI	<input type="text"/>	<input type="text"/>	<input type="checkbox"/> Under 100 spikes	<input type="checkbox"/> Over 100 spikes
Run Name	<input type="text"/>		<input type="checkbox"/> NO noise	<input type="checkbox"/> noise !
			<input type="checkbox"/> NO tower wake	<input type="checkbox"/> tower wake !
			<input type="checkbox"/> NO fallout	<input type="checkbox"/> Fallout !
			<input type="checkbox"/> NO misc. error	<input type="checkbox"/> Misc. error
			<input type="checkbox"/> NO errors	<input type="checkbox"/> ANY error

Figure C.3: This query results in 296 runs with mean wind speeds > 11 m/s recorded at site = “midgrund” at level 45 m.

Note: Browsing of run statistics and downloading of files is limited to a maximum of 500 files per query, however, all time series can be downloaded directly from the ftp-server (130.226.17.200).

C.1 View results

- Step 11.1: Press “View” to generate and view a list of matching mean wind speeds (cf. Figure C.4, where an extract of the matching “runs” are given, including links to the statistics for each “run” (header “Run name”)).

Statistics for midgrund, channel: ws45 page 1 of 12

Run name		Mean	Stdv	Min	Max	Range	Station.	TI.	Corr. TI.	Screening
199710040900	P.D.	11.55	1.39	7.70	16.25	8.55	0.01	12.0	12.0	TFTTF TTTT
199710040930	P.D.	11.69	1.64	7.29	18.31	11.01	1.03	14.0	13.8	TFTTF TTTT
199710041000	P.D.	12.70	1.98	7.87	18.87	10.99	1.20	15.6	15.3	TTTTF TTTT
199710041030	P.D.	15.62	1.93	9.56	22.09	12.53	0.61	12.4	12.3	TFTTF TTTT
199710041100	P.D.	15.69	2.32	9.82	22.47	12.65	4.39	14.8	12.4	TTTTF TTTT
199710041130	P.D.	16.70	2.52	10.23	23.43	13.21	3.18	15.1	14.0	TTTTT TTTT
199710041200	P.D.	14.63	2.38	8.82	22.70	13.88	-5.82	16.3	11.5	TTTTF TTTT
199710041230	P.D.	14.58	1.98	9.79	22.06	12.27	-1.16	13.6	13.4	TFTTF TTTT
199710041300	P.D.	14.66	1.91	9.60	21.58	11.98	0.47	13.0	13.0	TFTTF TTTT
199710041330	P.D.	15.10	2.07	9.99	22.52	12.53	2.79	13.7	12.7	TFTTF TTTT
199710041400	P.D.	15.57	2.39	9.76	24.73	14.98	-1.41	15.4	15.2	TFTTF TTTT
199710041430	P.D.	13.53	2.15	7.14	21.07	13.93	0.47	15.9	15.8	TFTTF TTTT
199710041500	P.D.	12.20	1.61	7.63	17.84	10.21	0.41	13.2	13.2	TFTTF TTTT
199710041530	P.D.	12.50	1.77	8.09	18.00	9.92	-2.63	14.1	12.8	TTTTF TTTT
199710041600	P.D.	11.82	1.77	6.95	18.62	11.67	2.18	15.0	14.0	TFTTF TTTT
199710041630	P.D.	13.01	1.77	7.74	19.78	12.03	1.61	13.6	13.1	TFTTF TTTT
199710041700	P.D.	11.73	1.49	6.96	17.10	10.14	-0.07	12.7	12.7	TFTTF TTTT
199710041730	P.D.	11.95	1.59	7.19	16.98	9.79	1.04	13.3	13.0	TFTTF TTTT
199710042000	P.D.	11.76	1.72	7.38	18.12	10.74	-1.26	14.7	14.3	TFTTF TTTT
199710042100	P.D.	12.66	1.86	7.81	19.39	11.58	2.68	14.7	13.3	TFTTF TTTT
199710042130	P.D.	13.00	1.80	7.26	19.12	11.87	-1.21	13.8	13.6	TFTTF TTTT
199710042200	P.D.	11.97	1.77	7.34	19.09	11.74	-1.74	14.8	14.2	TFTTF TTTT
199710042230	P.D.	11.42	1.29	7.91	18.37	10.47	-0.11	11.3	11.3	TFTTF TTTT
199710042300	P.D.	12.60	1.65	7.46	18.10	10.64	1.64	13.1	12.5	TFTTF TTTT
199710042330	P.D.	14.26	1.82	8.82	20.96	12.14	2.50	12.8	11.8	TFTTF TTTT

Next 25 matches

Figure C.4: First 25 matching speeds for channel=“ws45” at “site=midgrund” with mean wind speeds above 11 m/s.

Each line on the resulting page contains runname and statistical quantities (mean, standard deviation, minimum, maximum, range), together with turbulence intensity and trend corrected turbulence intensity. The last column contains the signal quality flag settings (based on the signal screening performed as part of the data registration).

- Step 12.1: Select “199710041300” to get run statistics for the channels available in this particular run (cf. Figure C.5);

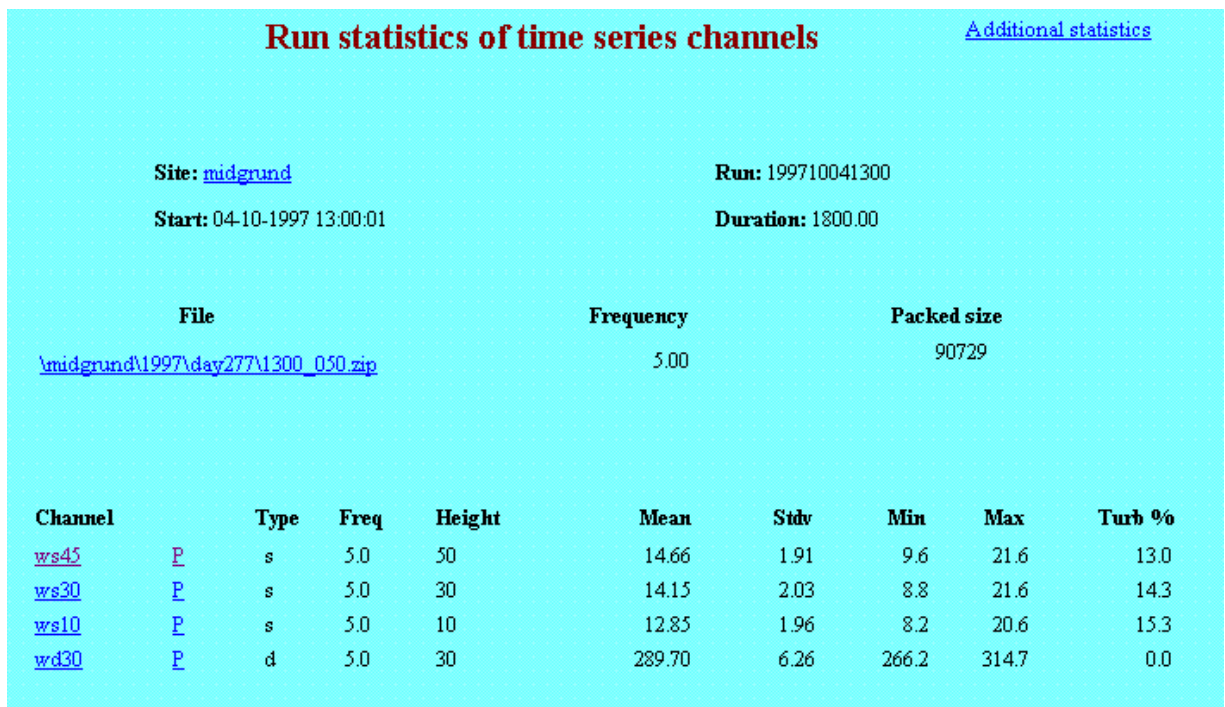


Figure C.5: Run statistics for “run=199710041300”.

Note: The run statistics page (Figure C.5) includes links to:

- 1) The site information “[midgrund](#)”;
- 2) File “[\midgrund\1997\day277\1130_050.zip](#)”;
- 3) Channels information “[ws45](#)”, “[ws30](#)”, “[ws10](#)” and “[wd30](#)”;
- 4) On-line plot of each channel “[p](#)”.

Statistics for the 3 additional channels are available from “[Additional statistics](#)”.

- Step 13.1. Select “p” to plot the time history for “channel = ws45” (cf. Figure C.5 and Figure C.6);

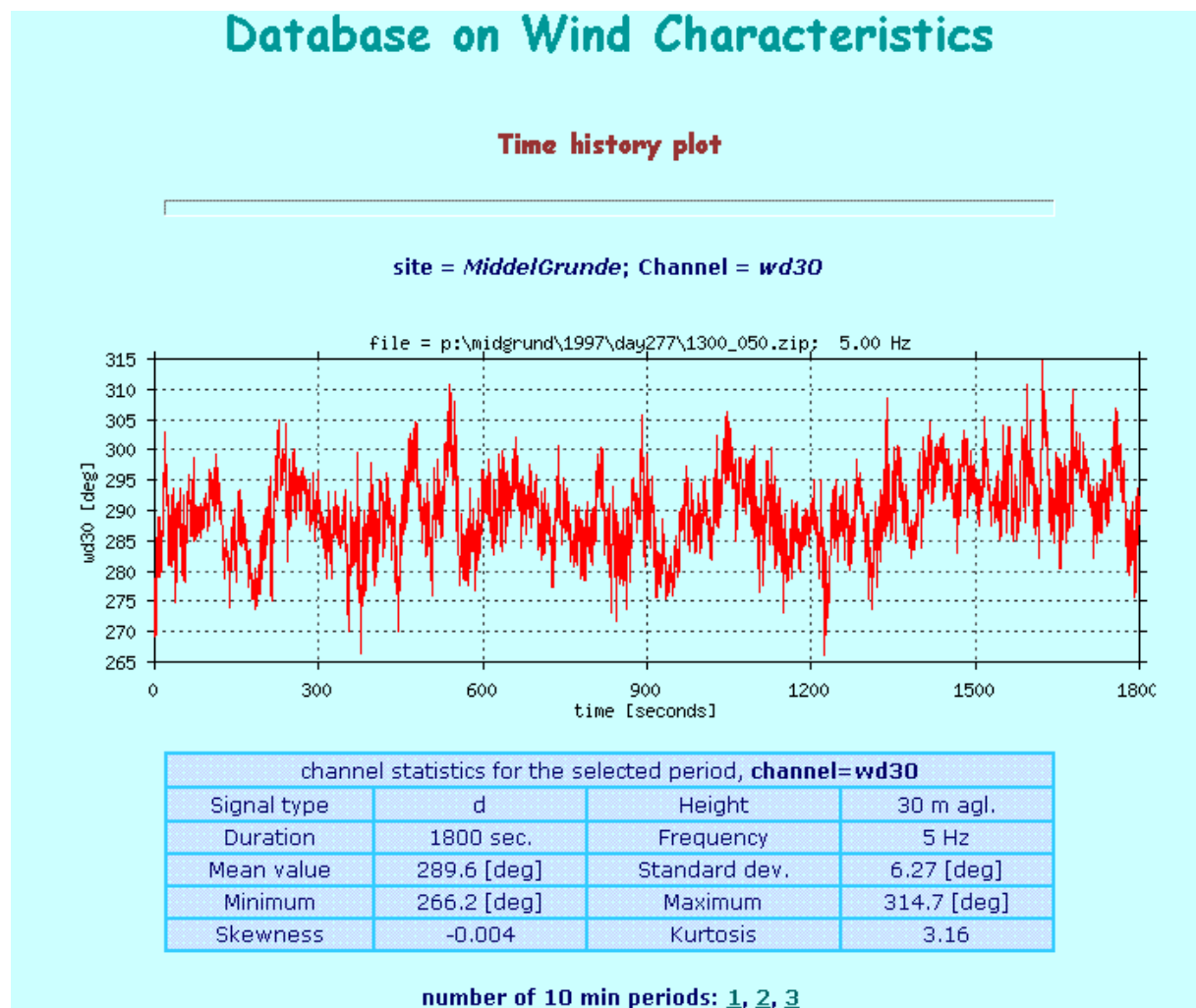


Figure C.6: Time series plot of “channel = ws45”.

Plots of identified time series are created on-line together with the statistics. For time series extending more than 10 minutes in time, a zoom facility is available down to a 10 minute level. For a 30-minute statistic situation the 10-minute time series zoom views are activated by pressing “1”, “2”, “3”, respectively (cf. Figure C.6).

C.2 Download results

- Step 11.2: Press “Files” to get a list of the files representing the specified mean wind speeds (cf. Figure C.3);

File list for matching runs (296 files, 24.49 MB)	
download text copy of file list	
File name	Packed size
\midgrund\1997\day277\0900_050.zip	89829
\midgrund\1997\day277\0930_050.zip	90596
\midgrund\1997\day277\1000_050.zip	90903
\midgrund\1997\day277\1030_050.zip	89624
\midgrund\1997\day277\1100_050.zip	89430
\midgrund\1997\day277\1130_050.zip	89971
\midgrund\1997\day277\1200_050.zip	89723
\midgrund\1997\day277\1230_050.zip	90321
\midgrund\1997\day277\1300_050.zip	90729
\midgrund\1997\day277\1330_050.zip	90745
\midgrund\1997\day277\1400_050.zip	90612
\midgrund\1997\day277\1430_050.zip	90553
\midgrund\1997\day277\1500_050.zip	90440
\midgrund\1997\day277\1530_050.zip	90400
\midgrund\1997\day277\1600_050.zip	90538

Figure C.7: File list for matching runs available for download from the ftp-server.

- Step 12.2: At this stage two alternatives for downloading of data are offered (cf. Figure C.7):
 1. Select “download text copy of file list” to get an ASCII copy of the file list, which can subsequently be used as input for automatic download (using the MS-Windows program “DBWIND.EXE” located in the software directory);
 2. Select File name = “\midgrund\1997\day277\1130_050.zip” to download this particular file from the ftp-server to YOUR workstation.

Note: All time series are compressed with PkZip.exe. PkUnZip.exe can be used to uncompress the compressed files (MS-DOS, WIN95, WIN98, WINNT & W2K). PkUnZip.exe is available from the software library.

C.3 Plot results

- Step 11.3: Press “Plot” to plot the identified speeds (cf. Figure C.3);

The screenshot shows a web-based interface for selecting plot parameters. At the top, it displays 'Site: midgrund' and 'Channel: ws45'. Below this, the text 'Choose plot parameters:' is followed by two dropdown menus. The first menu, labeled 'x axis parameter', lists various statistical and temporal parameters: 'time', 'mean', 'standard deviation', 'minimum', 'maximum', 'range', 'stationarity factor', 'turbulence intensity (ti.)', 'trend corrected ti.', 'skewness', 'kurtosis', and 'PDF'. The 'PDF' option is currently selected and highlighted in blue. The second menu, labeled 'y axis parameter', has 'mean' selected. A 'Plot' button is located at the bottom right of the interface.

Figure C.8: Plot options for channel =“ws45”.

- Step 12.3: Select desired values: x-axis parameter = “PDF” and y-axis parameter = “mean” (cf. Figure C.8). The plot options can be used to combine the x-axis and y-axis parameters in more than 100 different ways.
- Step 13.3: Press “Plot” to generate an online plot. The resulting plot is shown in Figure C.9.

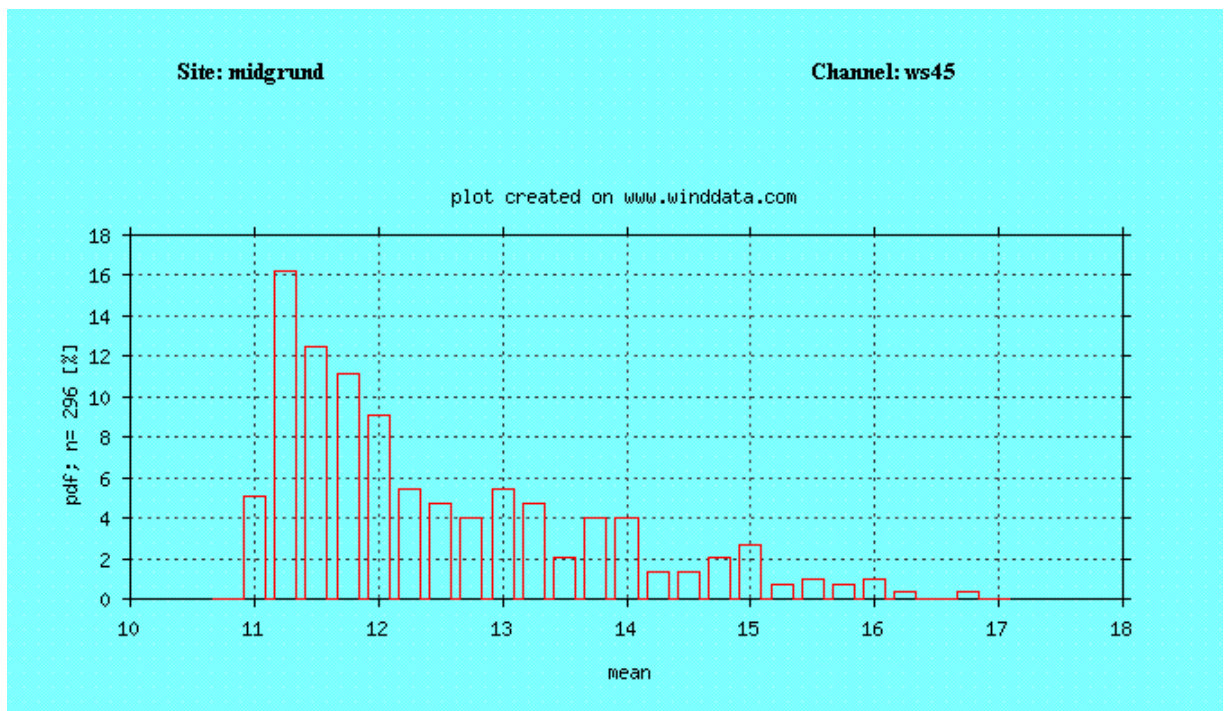


Figure C.9: Power density function of mean values, channel = “ws45”.

Appendix D: Example - Resource data query

The procedure described in Section 4.6 is illustrated by an example, where resource data from the site =“Alsvik” are retrieved from the database. The necessary steps is as follows:

- Step 1: Connect to the Web-server (<http://www.winddata.com/>);
- Step 2: select “Find wind data”;
- Step 3: Enter username and password (*note, that user registration is required!*);
- Step 4: Select “Registrered Login”;
- Step 5: Select “Resource data” among the available possibilities (cf. Table A.1);
- Step 6: Select site = “Alsvik” among the available possibilities (cf. Table D.1);

Resource data - Select a site:						
Site	Country	Orography	Terrain	Chs.	Span	Days available
alsvik	Sweden	Flat	Coastal	9	06-1991...08-1994	729 (63%)
ski	Norway	Hill	Coastal	10	01-1995...12- 1995	275 (75%)
tjare	Denmark	Flat	Pastoral	14	01-1988...03-1993	1410 (82%)

Table D.1: Available resource data sites.

Presently, the available sites include 2 coastal and one pastoral sites and covers 2414 days in total. However, new sites are continuously being included.

- Step 7, 8, 9, 10, 11, 12, 13: Select/disable channels to download, specify start/end of requested period, specify the preferred file period, select/disable header, select/disable zip-file-format and initiate down loading of the specified data. All these specifications and actions are performed using the screen picture illustrated in Figure D.1.

As seen at Figure D.1, the Alsvik site offers 9 different channels measuring channels:

- 6 cups with the altitude ranging from 10 - 53 m;
- 2 vanes located at altitude 53 m;
- 2 vanes located at altitude 53 m; and
- 1 thermometer located at altitude 3 m.

Select resource data from site: alsvik

Channel	Type	Height	Mast
<input checked="" type="checkbox"/> d18	d	53	1
<input checked="" type="checkbox"/> s18	s	53	1
<input type="checkbox"/> s14	s	31	1
<input type="checkbox"/> s11	s	10	1
<input type="checkbox"/> t11	tabs	3	1
<input type="checkbox"/> d28	d	53	2
<input type="checkbox"/> s28	s	53	2
<input type="checkbox"/> s24	s	31	2
<input type="checkbox"/> s21	s	10	2

First: Last:

File period: ☐ Header ☐ Zip files

Figure D.1: Selection page for Alsvik data.

Note: It is advisable to restrict the amount of data (in terms of periods and/or channels) before initiating download of data - otherwise the execution of the query will take inexpedient long time (hours!) and the download might fail in the end!

Typical processing time, according to tests, are:

2 channels, 1 year (one month per file) takes 15 seconds

2 channels, 1 year (one year per file) takes 15 seconds

2 channels, 4 years (one year per files) takes 50 seconds

- Step 14: Select the (zipped) files among the selected data from the database in order to transfer a copy to your computer (cf. Figure D.2);

Resource data from site: alsvik				
Below are the files containing the resource data you have selected from the database. Click on the files and choose "Save this file to disk" to store a copy on your local system.				
The files contain up to one month of data, starting at 00:00, 1st of the month (if available).				
You have selected the following channels:				
s18, d18				
File name	first scan	last scan	total scans	file size
19920101.zip	199201010000	199201300950	3753	28239
19920206.zip	199202061005	199202292350	2036	15619
19920301.zip	199203010000	199203240850	1826	14267
19920402.zip	199204020900	199204291020	2894	20971
19920501.zip	199205010000	199205230910	2054	16095
19920603.zip	199206030700	199206302350	3299	23339
19920701.zip	199207010000	199207312350	3084	22965
19920802.zip	199208020000	199208260910	2218	17649
19920903.zip	199209030000	199209302350	2737	18731
19921001.zip	199210010000	199210312350	2083	11779
19921101.zip	199211010000	199211302350	3897	23278
19921201.zip	199212010000	199212312350	3588	26399

Figure D.2: Selected resource data from site = "Alsvik".

- Step 15: Unzip the transferred zip-files. The resulting files are ASCII-files containing a descriptive header and the requested resource data. In Figure D.3 the content of the first file from Figure 2 is shown. The header (separated from the data by "===") contains general information on site and source of the data. The resource data part of the file is initiated by a channel list (scan, s18, d18). Scan indicates recording time (start of actual 10-minute period) - 199201010000 indicates that the

resource data refer to a 10-minute recording period starting at 1 January 1992 at time 00:00. The specifications in the channel list follows the conventional nomenclature applied in the database. In the present example “s18” thus indicates (10-minute statistics associated with) a cup recording at level 18 m, and “d18” indicates (10-minute statistics associated with) a wind vane recording at level 18 m. The channel list is followed by the actual resource data.

```
; File = 19920101.txt; generated 01-02-2001 15:17:11
; The statistics in this file are extracted from the Database on Wind Characteristics.
; The file contains resource data (mean values) from site = alsvik
; Details of the measurement setup are documented on URL=http://www.winddata.com
;=====
Scan,s18,d18
199201010000,12.65,222.46
199201010010,12.97,222.64
199201010020,13.66,224.57
199201010030,14.06,224.98
199201010040,14.36,225.71
```

Figure D.3: Example of a resource data file.

Title and authors

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67	6	31	3

Abstract (max. 2000 characters)

The main objective of IEA R&D Wind Annex XVII - Database on Wind Characteristics - is to provide wind energy planners and designers, as well as the international wind engineering community in general, with easy access to quality controlled measured wind field time series observed in a wide range of environments. The project partners are Sweden, Norway, U.S.A., The Netherlands, Japan and Denmark, with Denmark as the Operating Agent.

The reporting of IEA R&D Annex XVII falls in three separate parts. Part one deals with the overall structure and philosophy behind the database (including the applied data quality control procedures), part two accounts in details for the available data in the established database bank and part three is the Users Manual describing the various ways to access and analyse the data.

The present report constitutes part three of the Annex XVII reporting and contains a thorough description of the available online facilities for identifying, selecting, downloading and handling measured wind field time series and resource data from "Database on Wind Characteristics".

Descriptors INIS/EDB

DATABASE; EXTREME WIND; RESOURCE DATA; TURBULENCE; WIND; WIND ANALYSIS; WIND DIRECTION GUSTS; WIND FIELD DATA; WIND LOADING; WIND SHEAR GUSTS; WIND SPEED GUSTS; TIME SERIES; WIND STATISTICS; WIND TURBINE; WIND TURBINE LOADING.

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